Welding Engineer

September, 1960

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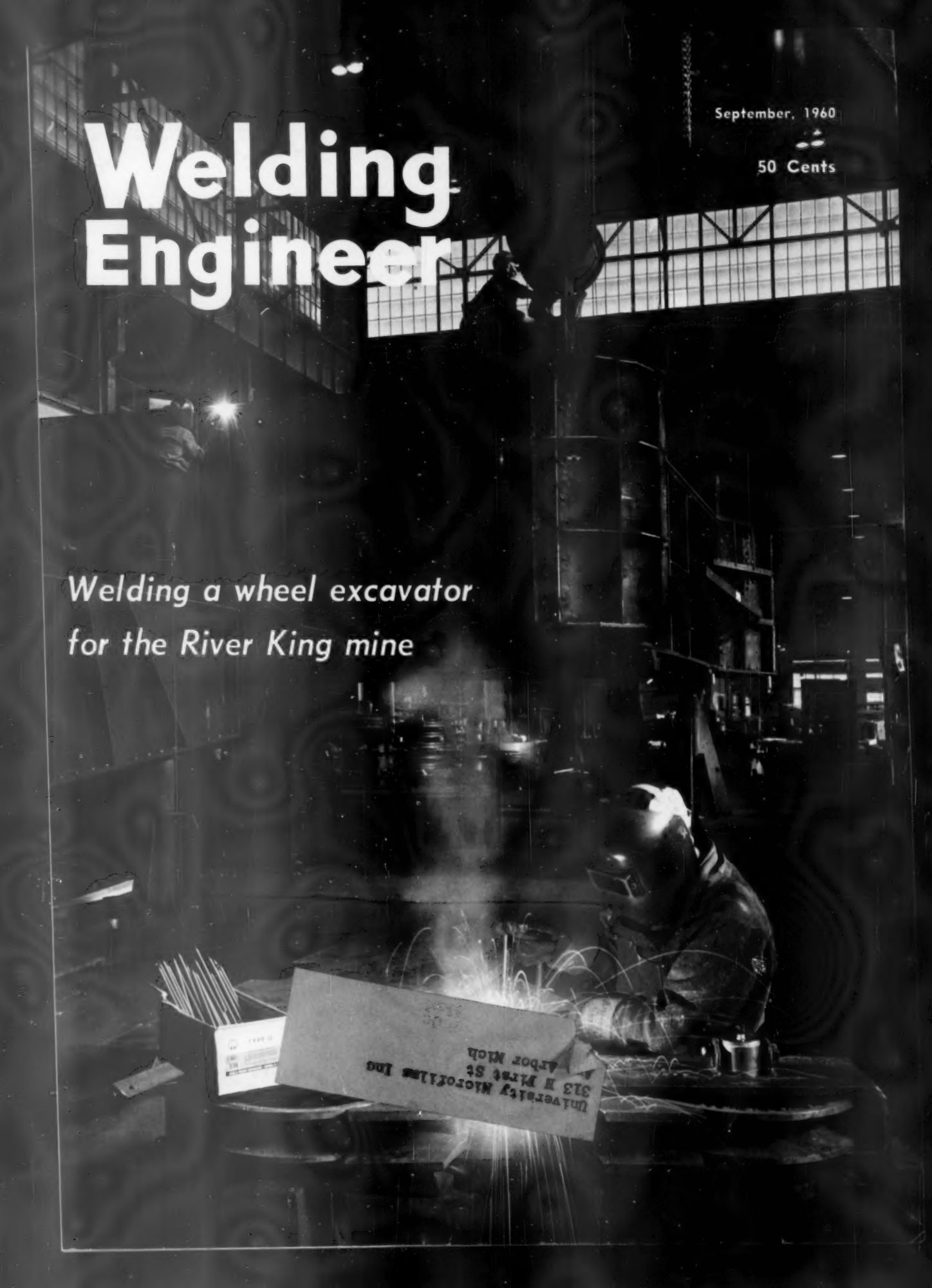
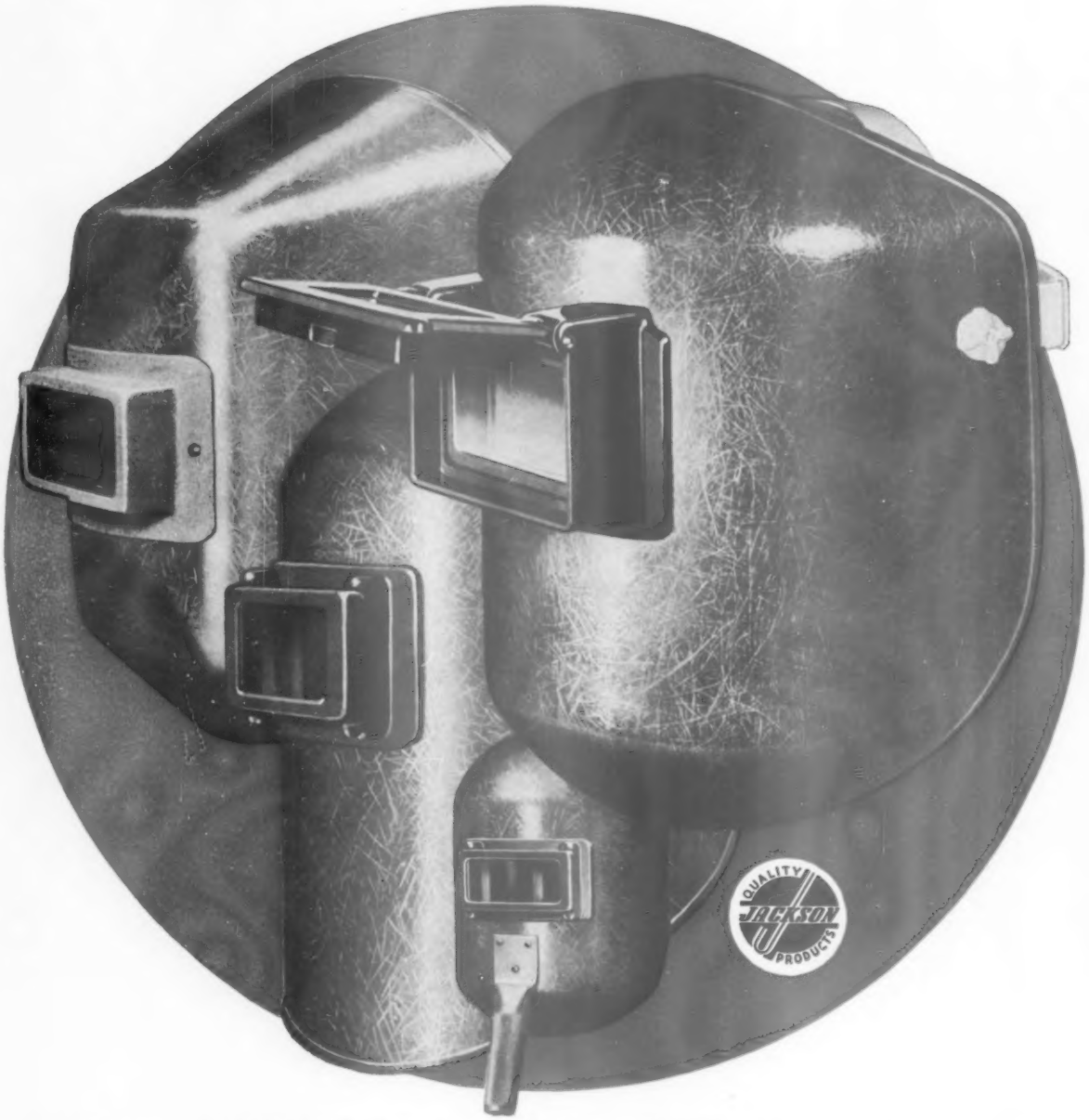


Welding a wheel excavator for the River King mine



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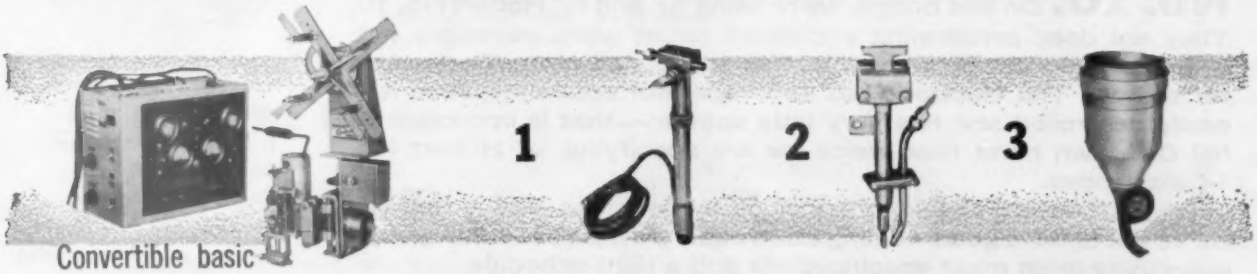

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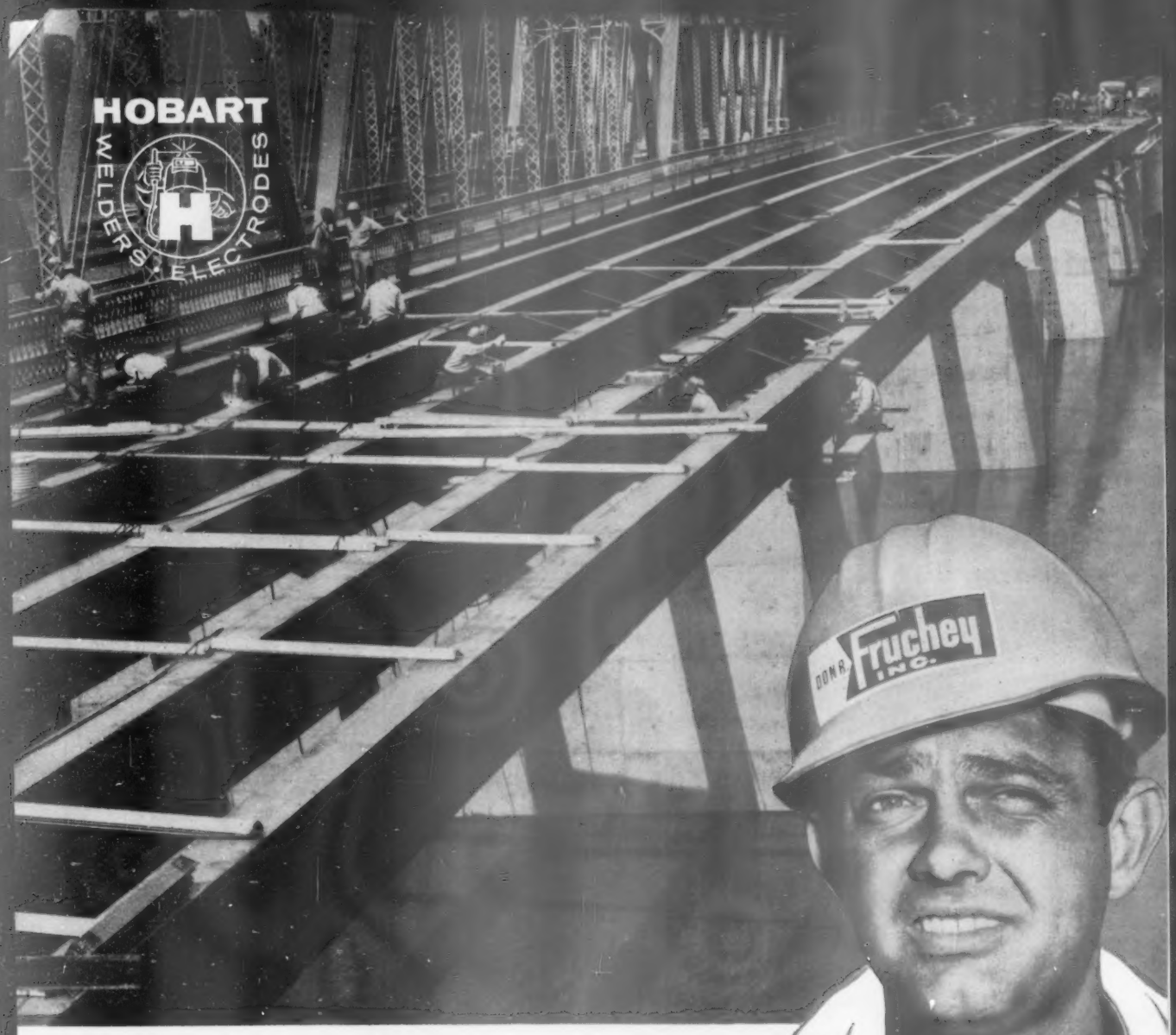

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Mr. Lawrence R. Place is Project Foreman for Don R. Fruchey, Inc., Fort Wayne, Indiana. The company does steel erecting, machinery moving, rigging and plant work.

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VOL. 45—No. 9

Welding Engineer

The magazine of joining and severing of materials

This is welding: September, 1960

Cover photo . . . shows welding of various components for a giant wheel excavator. See page 34.

Stainless steel overlay increases turbine life 29

Cavitation of turbine blades is extremely costly. Author **R. R. MacDonald** reports how a Canadian power commission doubled turbine life with stainless steel overlays — while an American welding contractor seeks a possible final solution in bubbles created by the blades.

Welding heat is chief factor in determining weld quality 30

► ► ► As new welding methods, materials and electrodes are developed, the effect of heat balance when welding base metals is usually overlooked. Design engineer **Nicholas S. Hodska** details the importance of welding heat and how to use it.

★ (For a reprint of this article, circle number 248.)

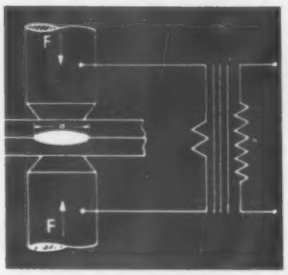
Welded Wheel Excavator moves earth far and fast 34

Next month one of a new breed of large-scale earth-moving machines will begin stripping 1.5 million cu ft of overburden per month at an Illinois mine. **Otis Young** outlines welding's contribution to its fabrication.

How to design for preform brazing 36

High speed, low costs and uniform quality are the three main purposes of automated brazing operations. Author **Harlan Olson** shows how joints properly designed for brazing preforms can help achieve results.

★ (For a reprint of this article, circle number 249.)



Theory and practice of spot welding 40

• • • • The first resistance welding was probably done by the village blacksmith, and the same principles still apply — with certain modifications. **Douglas D. Williams** explains the principles of spot welding and their applications.

★ (For a reprint of this article, circle number 250.)

Quality control is a must when welding radar antennas 58

The problems of building these giant watchdogs start with the more than one million parts, continue with the 168,000 ft of welding, and end with the requirement that they be designed for, and erected in, the Arctic. **W. R. Schneider** reports how these problems are met and how quality control is maintained.

Also in this issue:

Inspection program based on portable X-ray unit 43
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WELDING ENGINEER is published monthly with an additional directory number in June by Welding Engineer Publications, Inc. Publication office: 600 S. Seventh St., Rochelle, Ill. ©1960 by Welding Engineer Publications, Inc. Executive, editorial and advertising offices: 5826 Dempster St., Morton Grove, Ill. Circulation office: 4050 N. Milwaukee Ave., Chicago 41, Ill. Second class postage paid at Chicago, Ill. and at additional mailing offices. Subscriptions: U. S. and possessions, $3 per year.

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WELDING ENGINEER is indexed regularly by Engineering Index, Inc.

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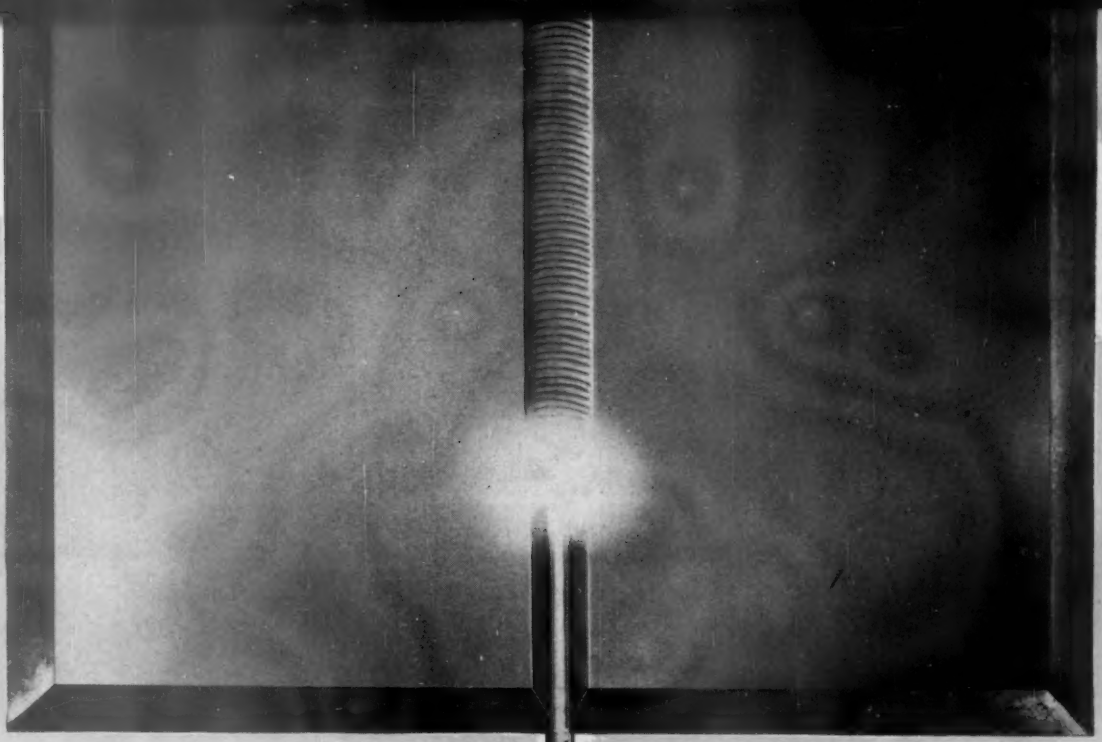

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Harstain "A" 309 Cb	E309-Cb-16
Harstain 309 Mo	E309 MO-15
Harstain "A" 309 Mo	E309 MO-16
Harstain 310	E310-15
Harstain "A" 310	E310-16
Harstain 310 Cb	E310 Cb-15
Harstain "A" 310 Cb	E310 Cb-16
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Harstain "A" 310 Mo	E310 Mo-16
Harstain 312	E312-15
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Harstain "A" 316	E316-16
Harstain 316 ELC	E316 ELC-15
Harstain "A" 316 ELC	E316 ELC-16
Harstain 317	E317-15
Harstain "A" 317	E317-16
Harstain 318	E318-15
Harstain "A" 318	E318-16
Harstain 330	E330-15
Harstain "A" 330	E330-16
Harstain 347	E347-15
Harstain "A" 347	E347-16
Harstain 349	E349-15
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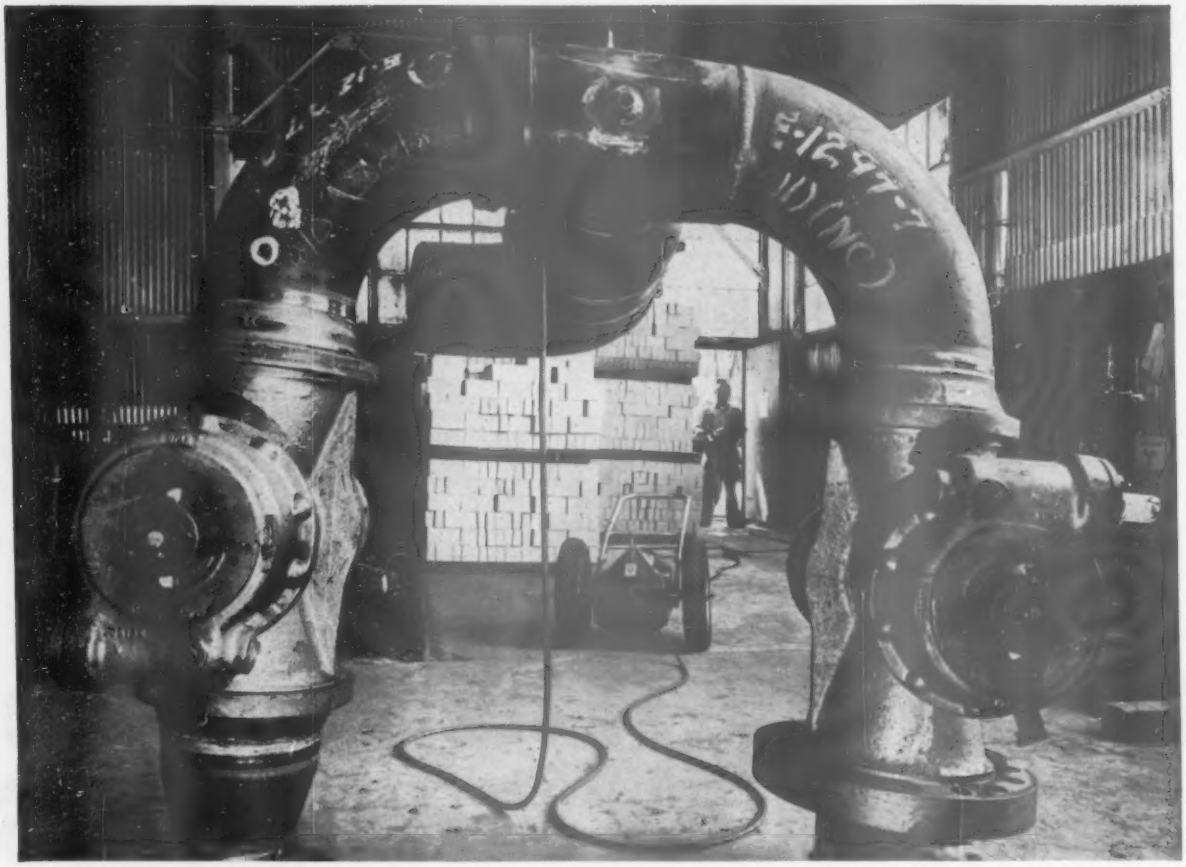

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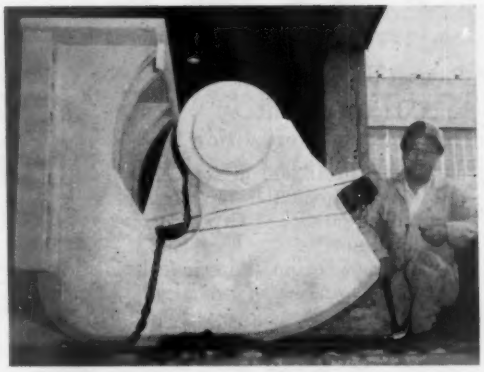


THIS hinge will open the doors of the underground silos from which the U. S. Air Force Titan ICBM will blast into space. Nearly 5-ft high, it is one of a set of 600-ton hinges welded, flame-cut and machined at Lukens Steel Co., Coatesville, Pa., for American Machine & Foundry Co., launching system contractor.

NEWS

51 papers scheduled for AWS fall meeting

Charles M. Parker, assistant vice president, American Iron and Steel Institute, will be the keynote speaker for the fall meeting of the American Welding Society, Sept. 26-29 in the Penn-Sheraton Hotel, Pittsburgh.

His talk will concern the growing importance of technical societies as leaders in education and research.

Fifty-one technical papers are scheduled for presentation, plant tours have been arranged, and a ladies' program and important education meetings organized.

G. O. Hoglund, Aluminum Co. of America, is in charge of the arrangements committee.

New England conference will focus on defense

"Welding in Defense" will be the major theme of the New England Regional Welding Conference, Oct. 13-14 in Boston.

Speakers representing industry and federal government agencies will discuss welding of underseas craft, surface ships, missiles and rockets, ordnance products and outer space vehicles.

The conference, which will be open to the public, will take place at the Commonwealth Armory.

Titanium conference set for Sept. 12-13

Various aspects of titanium metallurgy will be under consideration at New York University's sixth annual titanium conference, scheduled for Sept. 12 and 13 on the University Heights campus in the Bronx.

Sponsored by the university's college of engineering, the confernce will include talks on "The welding of Ti-13V-11Cr-3A1 all beta alloy," "Spot welding of the Ti-13V-11Cr-3A1 alloy," and "New welding processes for titanium."

Speakers will be drawn from research organizations, industry, and government.

The conference is sponsored by the Crucible Steel Co. of America, E. I. DuPont de Nemours and Co., Harvey Aluminum Co., Reactive Metals, Inc., Republic Steel Corp., Titanium Metals Corp. of America, and Union Carbide Metals Co.

Southeast industrial show to draw 10,000

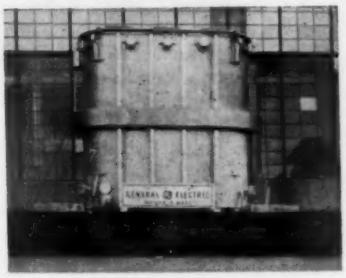
More than 10,000 persons, among them representatives from the region's welding industry, are expected to attend the 1960 Southeastern Plant Engineering, Maintenance, Welding, and Fleet Equipment Exposition.

The exposition, to be held at the State Fair Arena, Raleigh, N.C., from Sept. 14 through 17, will include a welding seminar.

Ultrasonics aid in transformer fabrication

Ultrasonic welding techniques played an important part in the manufacture of a prototype foil-wound aluminum power transformer.

The unit—first of its kind ever manufactured—was recently shipped by General Electric Co.'s



power transformer department at Pittsfield, Mass., to Aluminum Co. of America.

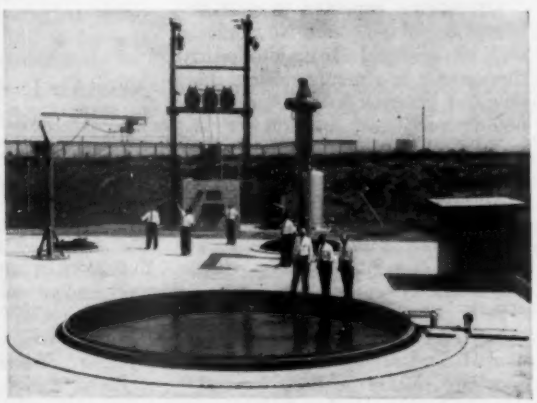
Intended for use as a power supply at Alcoa's Massena, N.Y., fabricating works, the transformer is made entirely of aluminum except for the core and a few mechanical accessories.

The prototype unit, which was two years in the making, has No. 3EC alloy aluminum foil windings in addition to an aluminum tank and radiators.

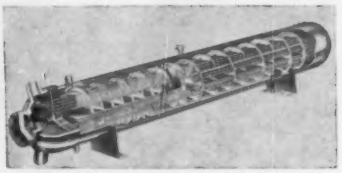
Ultrasonic welding came into play in joining transformer tap connections to the aluminum foil.

National Cylinder Gas offices consolidated

National Cylinder Gas Div., Chemetron Corp., has consolidated its McKees Rocks district sales office and its Pittsburgh medical branch office. Both now have headquarters at 3040 Bigelow Blvd., Pittsburgh.



OFFICIALS of Ryan Aeronautical Co., San Diego, inspect firm's new high energy forming facility at Kearney Mesa near Murphy Canyon. Water-filled pit in foreground is one of three forming pits to be used in instant formation of metal parts from tough alloys by small explosive charges. Ryan has shaped more than 200 intricate parts by means of this process.



Westinghouse develops improved tube-sheet joint

An improved joint between tubes and tube sheet in feedwater heater design has been developed by Westinghouse Electric Corp., Pittsburgh. Techniques developed for the construction of nuclear steam generators led to the new method.

Previously, tubes have been welded directly to a forged carbon-steel tube sheet. Now, a layer of nickel and additional layers of nickel-copper alloy are welded onto the surface of conventional tube sheet, and tubes are then welded to the cladding.

This clad-tube-sheet process makes joints which are metallurgically compatible with the tube material so that thermal stresses are minimized.

Automatic equipment used to clad the new design feedwater heaters can produce high-quality welds with either ferrous or nonferrous materials, including carbon steels, austenitic stainless steel, copper-nickel alloys, and high-nickel alloys.

Leased betatron to serve medicine, industry

Allis-Chalmers Mfg. Co., Milwaukee, has begun offering its betatrons under a lease arrangement.

The first lease for a 25-million volt betatron has been entered into by the firm with a radiologist in Massilon, Ohio. The unit will be installed in a radiology building in that town.

Operations, expected to start at Massilon about mid-November, will be two-fold. In addition to therapeutic treatments during the day, the betatron will be used for non-destructive inspection of a variety of materials during evening hours.

The unit in the Massilon building will include a combination X-ray-/electron beam tube and a rotating, twin telescoping tube suspension system.

Principal advantages of high voltage X-ray inspection are substantial time saving and ability to penetrate thicker sections beyond the range of other non-destructive test equipment while maintaining excellent radiographic quality.

15,000 expected at Iron & Steel Convention

Upwards of 15,000 persons are expected to attend the 1960 Iron & Steel Convention and Exposition, Sept. 27 through 30 in Cleveland.

Featured will be 42 technical papers and exhibits of advanced and standard production equipment by nearly 200 steel industry suppliers. Occupying 15% more display area than previously, the exposition has been sold out since early May.

Among significant developments to be reviewed at the convention are: advanced practices in automated steelmaking, new techniques for increasing blast furnace output, a new British oxygen steelmaking process, and new techniques for changing the chemistry of steel through practice.

An analysis of today's tube welding processes will be the subject of a paper to be delivered by Norbert C. Rubin, vice president, The Yoder Co., Cleveland.

Lecture series planned by N. Y. AWS unit

A 16-week course covering the principles of welding and brazing technology will open Sept. 20 at Rensselaer Polytechnic Institute in Troy, under the sponsorship of the Northern New York Section of the AWS.

Beginning with fundamentals, instructors will attempt to cover the subjects in a way which will be equally useful to persons untrained and to professionals interested in a refresher course.

Sessions will be held from 7 to 9 p. m. on successive Tuesdays. A field trip to the materials and processes laboratory of General Electric Co., Schenectady, N. Y. has been tentatively scheduled for December.

New Air Reduction facility opened

Executives of Armco Steel Co., Middletown, Ohio, and Air Reduction Sales Co., New York City, recently placed on stream a new "on site" liquid-air separation plant at Butler, Pa.

The plant, which has a capacity of 120 tons of high purity oxygen per day, will supply the gas by pipeline directly to the Butler works of Armco.

COMING EVENTS

SEPT. 15-16: NWSA Central Zone meeting, Sheraton-Cleveland Hotel, Cleveland.

SEPT. 19-20: NWSA Eastern Zone meeting, Hotel Commodore, New York City.

SEPT. 26-29: Fall Meeting, American Welding Society, Penn-Sheraton Hotel, Pittsburgh.

OCT. 4-6: AEC Welding Forum, Hilton Hotel, San Antonio, Tex.

OCT. 13-15: AWS Western Welding Show, Exposition Hall, Santa Clara County Fair Grounds, San Jose, Calif.

OCT. 17-18: NWSA West Central Zone meeting, Hotel Muehlebach, Kansas City.

OCT. 17-21: 48th Annual Safety Congress, Chicago; 1960 National Metal Show, Trade and Convention Center, Philadelphia.

OCT. 21-22: NWSA Western Zone meeting, Ambassador Hotel, Los Angeles.

NOV. 28-29: NWSA Southeastern Zone meeting, Hillsboro Hotel, Tampa.

DEC. 1-2: NWSA Southwestern Zone meeting, Hotel Roosevelt, New Orleans.

DEC. 5-8: 1st Biennial Short Course on Welding Engineering, University of Illinois, Urbana, Ill.

TWO Chicago high school students recently received $500 awards from the Chicago section of the American Welding Society. The prizes were for presentation of outstanding displays in a high school science fair at the city's Museum of Science and Industry. Winners were Paul Leif (above) and Thomas Keys (below), both 17. Leif's exhibit was an underwater torpedo-like instrument designed to measure temperature, pressure, and radioactivity of water. Keys' demonstration of a "magnetohydrodynamic generator" explained the nature of a welding arc. Presenting the awards is Harry Schwartzbart, supervisor of welding research at Armour Research Foundation.

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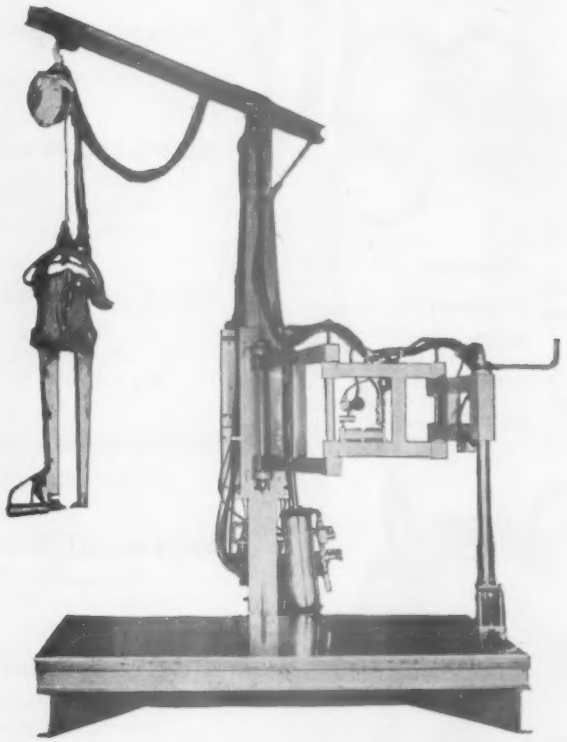
Series Head with 33" vertical retraction

Capacity to 16 gage steel



60" x 90" Copper Shunt Bed

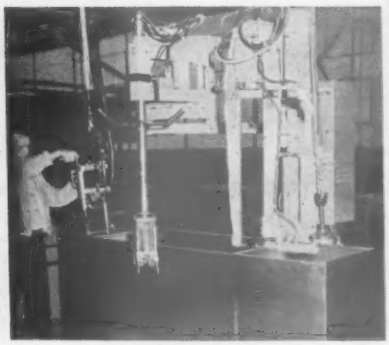
32" Throat Air Operated Gun for vertical seams

7" C Type Air Operated Gun for Corner Welds

All welds make from one setup

Make all the welds needed to build a box without moving the box from the COOPER BOX WELDER.

Corner and Reinforcements



Weldment on Shunt Bed

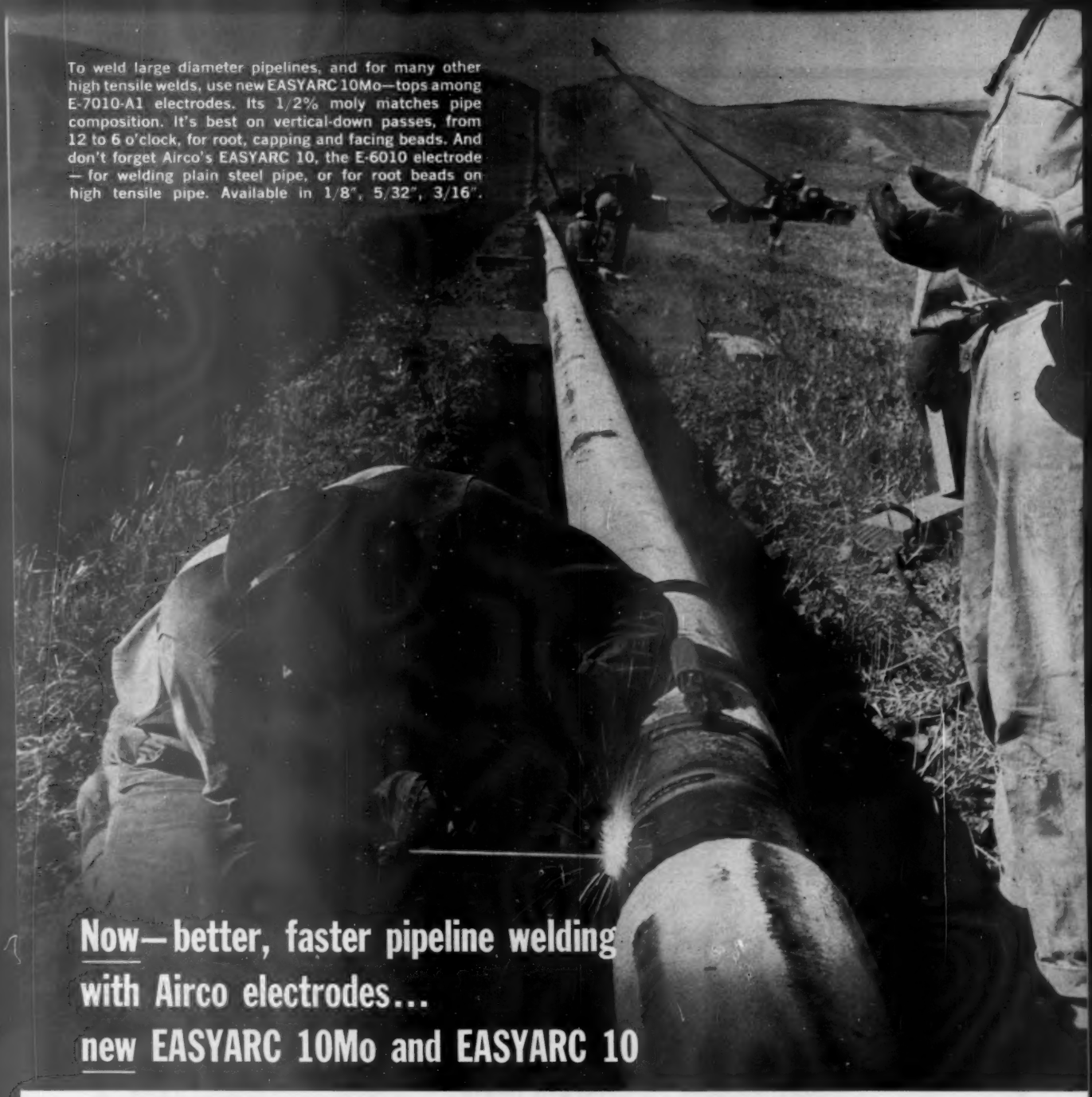
Series Welder welds in Bottom

Deep Throat Gun for Vertical Seams

COOPER WELDERS, INC.

MORTON GROVE, ILLINOIS

For more facts Circle No. 157 on Reader Service Card



To weld large diameter pipelines, and for many other high tensile welds, use new EASYARC 10Mo—tops among E-7010-A1 electrodes. Its 1/2% moly matches pipe composition. It's best on vertical-down passes, from 12 to 6 o'clock, for root, capping and facing beads. And don't forget Airco's EASYARC 10, the E-6010 electrode — for welding plain steel pipe, or for root beads on high tensile pipe. Available in 1/8", 5/32", 3/16".

Now—better, faster pipeline welding with Airco electrodes... new EASYARC 10Mo and EASYARC 10

If you're welding pipelines of the high strength steels—use Airco electrodes. They offer unbeatable welding characteristics, whether pipe diameters are 3 or 30", walls thin or thick. They're designed for the job, and are all Airco-engineered.

They are also ideal for many other industrial applications. Whatever your stick welding application—choose from Airco's 119 electrode types: stainless, mild steel, low alloy, low hydrogen, metal powder, aluminum, bronze, cast iron and hardfacing.

Phone your Authorized Airco Distributor. He's in your Classified Telephone Directory under "Welding Equipment and Supplies."

AIRCO®

AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated

150 East 42nd Street, New York 17, N. Y.

More than 700 Authorized Airco Distributors Coast to Coast

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THE GAUGELESS REGULATOR

AN ORIGINAL **HARRIS** DEVELOPMENT AND A ***PROVEN PRODUCT***

The No. 77 was originally designed, developed and manufactured by Harris to meet industry's need for a completely new, damage-proof gaugeless regulator.

It has proven itself to be just that, under rugged operating conditions.

It's a rugged regulator and completely safe! Possibility of damage — internal or external — has been virtually eliminated.

Acceptance of this regulator around the world stems from many reasons, as shown below. Check with your Harris distributor today.

Adjusting screw can be left in any position without damage to seats or diaphragms.

Thimble protects adjusting screw threads and shows pressure adjustments.

Easily read working pressure indicator replaces low pressure gauge.

Approved by underwriters laboratories.

Short inlet connection reduces breakage, readily removed for replacement.

Nut supported over inlet stem to prevent damage to stem seat.

High pressure cylinder content indicator, indicates ¼, ½, ¾ and full. Replaces high pressure gauge.

First and second stage safety valves.

MODEL NO.	TYPE	DELIVERY RANGE POUNDS
X-77	Oxygen	0 to 200
77	Oxygen	0 to 100
77-A	Oxygen	0 to 50
77-P	P.O.L. Acetylene	0 to 15
X-77-P	P.O.L. Propane	0 to 50
77-D	Coml. Acetylene	0 to 15
X-77-D	Coml. Propane	0 to 50

3114-HC

HARRIS

Building World-wide Customer Confidence with Advanced Design Welding and Cutting Apparatus

THE HARRIS CALORIFIC COMPANY, 5501 CASS AVENUE, CLEVELAND 2, OHIO

For more facts Circle No. 159 on Reader Service Card

WELDING ENGINEER

Your September, 1960 *Weld World*

As WE went to press, these were the industry's latest developments:

. . Directors of The Federal Machine and Welder Co., Warren, Ohio, have approved a proposal from The McKay Machine Co., Youngstown, Ohio, offering Federal stockholders an exchange of McKay common stock for Federal common stock. Stockholders of Federal were expected to vote on the offer this month.

. . Westinghouse Electric Corp. has changed name of its Welding Dept. to West-Ing-Arc. This established trade name will henceforth apply to all products of the department, as well as to the department (headquartered in Buffalo) itself.

. . Another name change: Metallizing Engineering Co., Inc., Westbury, N. Y., becomes Metco, Inc.

. . After 18 months of test marketing a new family of high-strength heat-treated steels is being made available for nationl distribution. Developed by Great Lakes Steel, Detroit, a division of National Steel Corp., Pittsburgh, the alloy is said to possess "excellent weldability, formability and ease of fabrication." Columbium is one of the alloying elements.

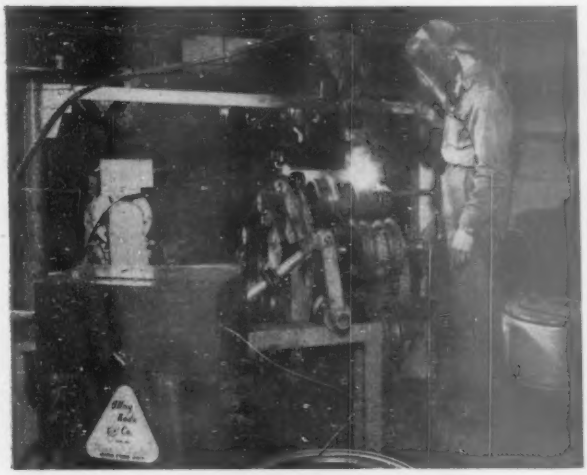
. . Contract to study welding of molybdenum and tungsten by the electron-beam process has been awarded by the Air Force to Hamilton Standard, division of United Aircraft Corp., Windsor Locks, Conn.

. . Speaking of Hamilton-Standard, members of the International Association of Machinists voted to accept a contract offer last month and return to work. Two plants had been struck.

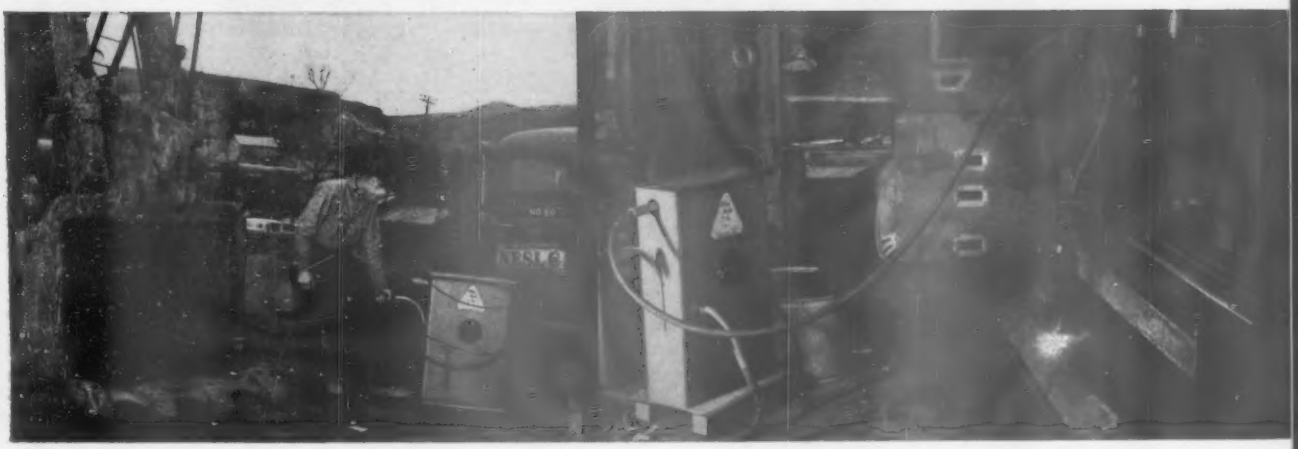
. . A flux-coated silver-brazing alloy—claimed to be a "first"—has been developed by Eutectic Welding Alloys Corp., Flushing, N. Y. Flux coating is extruded on core wire.

. . A high-capacity oxygen plant for its steel division will be built by Ford Motor Co. Scheduled for completion late in 1961, the plant will produce daily (at peak capacity) 280 tons of gaseous oxygen, 10 tons of liquid oxygen and 1.4 tons of liquid nitrogen. Dravo Corp., Pittsburgh, will construct the generating plant.

. . In most areas, business continues better than last year, though not up to some of the more optimistic predictions voiced at the end of 1959 . . . Air Reduction Co., Inc., New York City, set a new sales record for six months during first half of this year . . . RWMA reports shipments of resistance-welding equipment were up 26% for first six months of 1960 . . . Yet, nationally, business failures were up over last year–7,707 to 7,368.



Enterprising Raymond Steele, always alert to new time saving methods, constructed this six spindle roller rebuilder utilizing the Wear-O-Matic open arc hard surfacing process, greatly increasing the efficiency of his operation. Geared to the constant feed of Wear-O-Matic alloys from 100 pound Weld-Paks, this machine turns out roller after roller rebuilt and hard surfaced with long wearing deposits.



Equipment too large or cumbersome to be moved to the shop for rebuilding can be hard surfaced semi-automatically at the job site. The versatile Wear-O-Matic Wire Feed Unit and Weld-Pak is easily transported for field application of Wear-O-Matic wires.

By attaching the Wear-O-Matic welding nozzle to an automatic travel device, New Enterprise rebuilds crusher hammers automatically at a tremendous savings over manual applications. In addition, the weld deposit is smoother and more uniform.

New Enterprise Stone & Lime Co., Roaring Springs, Pennsylvania, operates seven plant locations in west-central Pennsylvania. This diversified, complex organization produces ready-mix concrete, pulverized rock, agricultural lime, black-top road material and pre-stressed concrete structures in addition to road and sewer construction projects and turnpike maintenance. Trucks, shovels, dozers, loaders and other movable equipment are maintained at the central maintenance shop in Roaring Springs under the guidance of Raymond Steele, Maintenance Supervisor.

Production Soars—Costs Go Down for Maintenance Shop Handling Seven Quarries

WEAR-O-MATIC PROCESS PROVIDES THE ECONOMY AND VERSATILITY NECESSARY FOR A VARIETY OF EQUIPMENT

Maintaining the equipment necessary for operating seven plant locations keeps even the well equipped, efficient shop of New Enterprise Stone & Lime Co. hustling for time saving, cost saving methods. The production per man hour possibilities of the Wear-O-Matic hard surfacing process led Mr. Raymond Steele, Maintenance Supervisor, to purchase one of the first Alloy Rods Company Wear-O-Matic Wire Feed Units. The results were so outstanding in time saving, diversified uses and superior, long-wearing deposits from Wear-O-Matic wires that New Enterprise now employs four Wear-O-Matic units in its program.

Says Mr. Steele . . . "With the Wear-O-Matic process, we put down 3 to 5 times more weld metal per hour than with stick electrodes. With no waste from left over stub ends, the semi-automatic wire costs us less per pound. Another item that saves valuable time . . . once you strike the arc with Wear-O-Matic, you don't stop until the job is finished. You get 100 pounds of continuous electrode in each Weld-Pak, ideal for our automatic set-ups. The deposits we get with Wear-O-Matic wires really hold up. We've had better results than with any other wire we've ever tried, and we have tried most of them."

Productive capacity, operating costs, deposit quality, shop versatility are important factors for efficient maintenance operations. The Wear-O-Matic hard surfacing process provides these advantages and at a cost within the range of any shop regardless of size. Find out now how the Wear-O-Matic process can increase the capacity of your maintenance shop.

Call your Alloy Rods Company distributor or representative for a Wear-O-Matic demonstration in your own shop. Or write to Alloy Rods Company, P. O. Box 1828, York 2, Pa., for more information.

ALLOY RODS COMPANY

YORK, PENNSYLVANIA

SALES OFFICES & WAREHOUSES; BOSTON, NEWARK, PHILADELPHIA, PITTSBURGH, BIRMINGHAM, CHICAGO, SAN FRANCISCO & EL SEGUNDO, CALIF.—DISTRIBUTORS IN ALL OTHER PRINCIPAL CITIES

TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES

For more facts Circle No. 160 on Reader Service Card

Letters...

Pleased

TO SAY THAT I WAS PLEASED WITH YOUR JUNE NDT ISSUE WOULD BE A GROSS UNDERSTATEMENT. CONGRATULATIONS ON A FINE JOB IN COVERING X-RAY METHODS.

J. F. McGlynn
Ansco Div., General Aniline & Film Corp.

Welding scholarship

Sir: *Flint, Mich.*

As an engineering educator, it is gratifying to me to know that WELDING ENGINEER has established a scholarship for students in welding engineering at Ohio State University.

This is the kind of support that will enable the colleges and universities to better meet the needs of industry for welding engineers in the future. It is my sincere hope that others will follow your example to encourage students to study welding engineering and to support the top-flight job being done by Professor Roy B. McCauley and his cohorts at O.S.U.

Your action in the support of welding equals your editorial words! We are pleased to be associated with a profession that contains men of purpose and action such as you. Yours for more and better welding engineers.

Morris D. Thomas
General Motors Institute

Automated hardfacing

Sir: *Caracas, Venezuela*

We will appreciate very much if you can give us information on the manufacturers of the automatic welding machines used by Wheeler Machinery Co. of Salt Lake City, to rebuild rails and tractor rollers.

We are asking for this information because we read in your May issue on page 46 the article "Photoelectric control aids weld uniformity." If you know of any other manufacturer of welding machines for hardfacing we will appreciate your help on this matter.

Thanking you in advance . . . we remain,

Juan Cantor Soria
Semca

(*Three companies producing this kind of equipment are: Rexarc, Inc., West Alexandria, Ohio; Victor Equipment Co., 844 Folsom St., San Francisco 7, Calif.; and Automatic Welding, Airport Road, Waukesha, Wis. — Ed.*)

Welding uranium

Sir: *Miamisburg, Ohio*

Could you please tell me on or about the time that uranium was welded in the United States ?

Have been a reader of your magazine for the past five years, enjoy and receive a great many benefits from it.

Boyd N. Wilson

(*According to the best information we have, techniques for welding uranium by the Tig process were developed in 1957 by the Los Alamos Scientific Laboratory in New Mexico—Ed.*)

"On your toes, Sid — Fatso is in this end of the plant!"

The Most Advanced Line of Welding Aids Ever Produced for PIPE-LAYOUTS of ANY Type or Location

CURV-O-MARK
CONTOUR MARKERS

Marks off any pipe joint or structural angle cut accurately, easily and without figuring cutbacks. Marks all around pipe—saves time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diam.

CURV-O-MARK
CENTERING HEADS

Really, 5 tools in one—it replaces Protractor, Centering Head, Center Punch, Level and Scale. Eliminates difficult measuring, checking and marking. Pocket size—weight only 9 ozs.

CURV-O-MARK
RADIUS MARKERS

Has marking span of 24" and swings to 48" circle or arc. Pencil holder accommodates round or flat pencils, soapstone and steel points. Unequaled for accurate layout work. Wt. 8 oz., pocket size.

CURV-O-MARK
PIPE FLANGE ALIGNERS

For Aligning Slip-on, Top Joint, Stub End and Welding Neck Flanges. This self-centering Tool is quickly adjustable for all types of Flanges or Pipe sizes from 3" to 12" in diameter.

CURV-O-MARK
Ang-Lo-Cator Protractor

An easy way to find accurate angles on pipe and structural material. A valuable aid to welders, structural workers and pipe fitters. Size 4" x 8"

Your Welding Supply Dealer Recommends all CURV-O-MARK Products

CONTOUR SALES CORPORATION
1843 E. COMPTON BOULEVARD • COMPTON, CALIFORNIA

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Modern welding processes like these demand a modern power supply!

*** TIG** (Tungsten Inert Gas) *** MIG** (Metallic Inert Gas)
*** Short Arc * Submerged Arc**
*** Magnetic Flux**

Never underestimate the importance of the power supply to the proper operation of today's improved welding processes.

Weld quality, appearance, speed and economy all depend on matching arc characteristics to the requirements of the process and the material. If your power supply can't produce the required characteristics, you're sure to lose some or all of the performance you want.

Glenn Pacific, working closely with major welding process development engineers, has kept pace with process requirements. For example, GLENN constant voltage power supplies with linear slope control have solved major problems in MIG and Short Arc welding on aluminum and ferrous alloys, and many exotic "space age" metals.

Get the facts *now* about GLENN Power Supplies matched to your welding needs—you'll be hours and dollars ahead! For details, please address Dept. 137.

Glenn Constant Voltage Power Supply with Stepless Vernier Slope Control

GLENN PACIFIC
POWER SUPPLY CORPORATION

703-37th Avenue • Oakland 1, California
Originators of CV Power Supplies

Eastern Office
221 Dukes Rd., Rahway, N. J.

Midwestern Office
640 So. York, Elmhurst, Ill.

* GLENN Balanced Wave Power Supply for TIG Welding * GLENN Manual and Stud Welder Power Supply * GLENN Arc Gouger Power Supply * GLENN Constant Potential Welder for "Gang" Manual Welding * GLENN Industrial Power Supplies and Heavy Duty Variable Voltage Transformers

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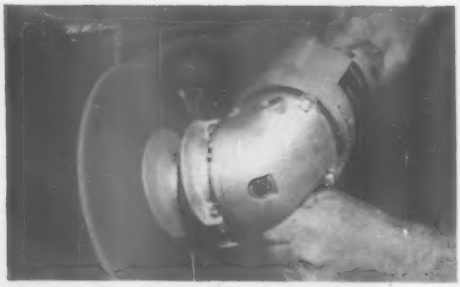
"Man, we never had it so good!"



BAY STATE'S NEW "KOOLIE HAT" Wheels

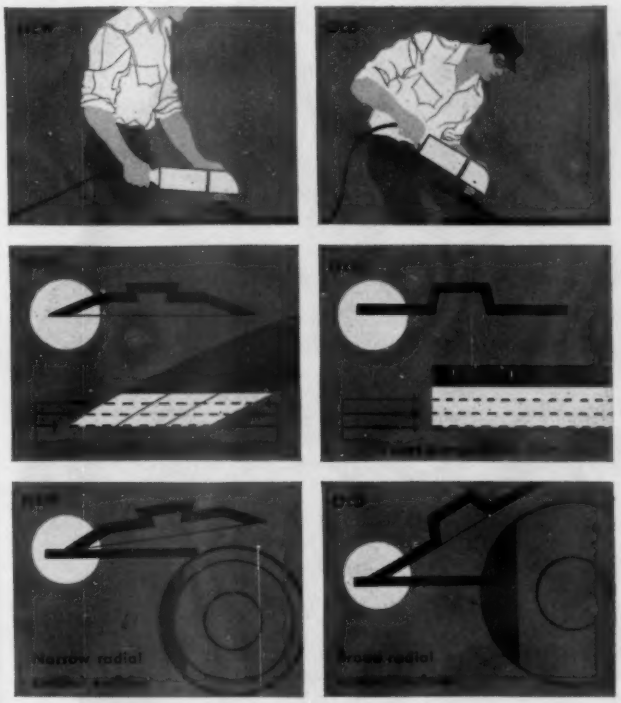
are easier, safer and faster . . .

This new wheel shape removes one of the prime causes of accidents in portable grinding and blending, by cutting operator-fatigue. It increases cutting speed, too. Triple-layer, resin-bonded fiberglass construction gives Bay State's new "KOOLIE HAT" wheels extra strength, durability and a controlled contact area so important to portable snagging wheel users.

• Easier Operation
"Koolie Hat" wheel is held at 4° to 5° angle to the horizontal instead of 25° to 30° . . . requires less pressure to hold grinder steady . . . virtually eliminates jitter and bounce, due to extended peripheral contact. Operator grinds in relaxed position with both arms extended about equally... fatigue drops . . . accident rate goes down . . . production climbs.

• Extra Safety
"Koolie Hat" shape ensures uniform wear of all three layers of abrasive at once . . . even when wheel is held flat for smoothing and cleaning. This eliminates danger that results when conventional disc-wheels wear thin over entire surface (see diagram). Prevention of heat build-up also reduces danger of breakage due to heat cracks.

• More Uniform Speed
New "Koolie Hat" shape provides a narrow, radial contact surface between wheel and work. This means that wheel speeds stay high, ensures fast, efficient removal of metal and prevents heat build-up.



These remarkable new wheels are available in two sizes: 7" x ¼" and 9" x ¼". Your Bay State distributor or direct representative is ready now to demonstrate on your work, at your plant. Write today.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

For more facts Circle No. 163 on Reader Service Card

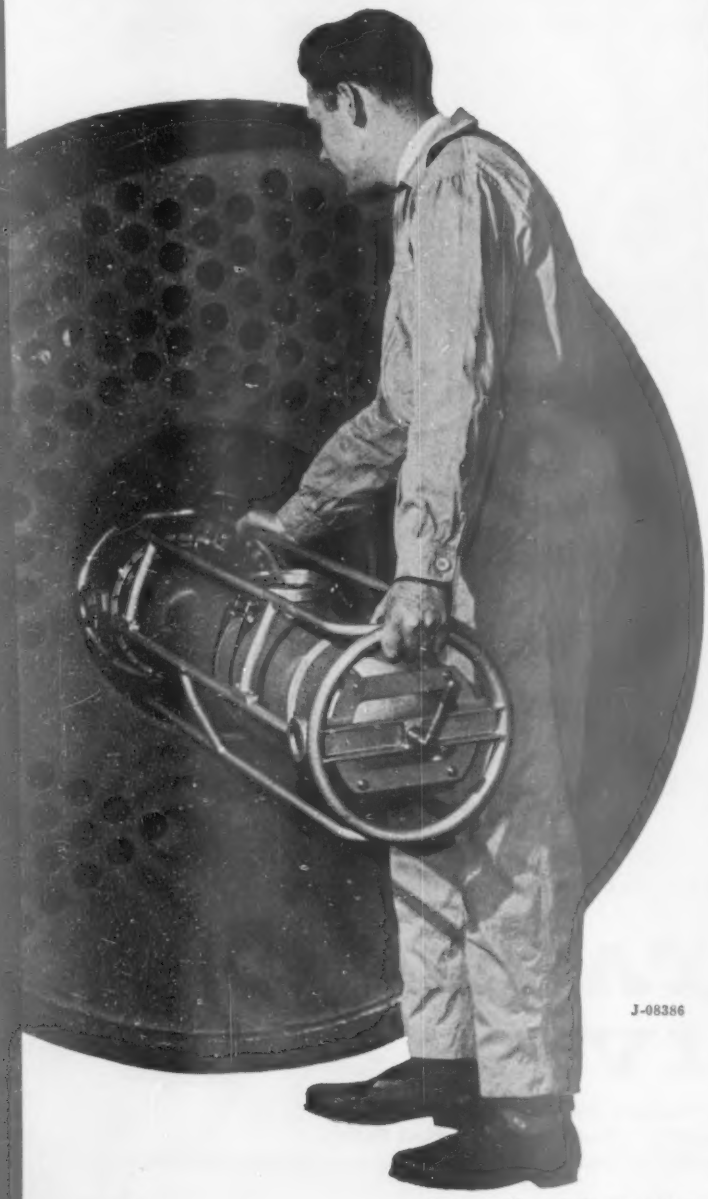
NEW FROM WESTINGHOUSE

BALTOGRAPH 300 PENETRATES UP TO 4" OF STEEL

permits 360° radiography and can be coned down to a single beam . . . yet weighs only 136 lbs.

This is the first industrial X-ray unit designed specifically to meet *all* radiographic inspection requirements, from thin aluminum up to 4" thick steel. Simple to operate . . . requiring only a few hours instruction.

For a free demonstration—at your plant or job site—just call, wire, or write to Mr. Dan Maus, X-ray Department, Westinghouse Electric Corporation, 2519 Wilkens Avenue, Baltimore 3, Md.—*You can be sure . . . if it's Westinghouse.*



J-08386

SPECIFICATIONS

X-ray Head

X-ray tube, lead shielding, HT transformer, filament heating transformer, and automatic thermal cutoff device are all mounted in a single lightweight housing.

X-ray portal: Total X-ray beam is 360° circumferential
Focus size: 3 x 3 mm
Inherent Filtration: Low
Shielding: 5 mm of lead
Power rating: Self-rectified 300 KVP-3MA
Weight: 136 lbs.
Dimensions: 46¼ long, 12¼ diameter

Control Panel

Hermetically-sealed penetration meter, penetration selector, MA control, and automatic push button reset timer mounted in rugged metal cabinet.

Power Supply: 115 or 230 volts, 60 cycles, single phase
Weight: 41 lbs.
Dimensions: 15" x 12" x 7"
Also included: 25' and 60' connecting cables and individual carrying cases.

Westinghouse

For more facts Circle No. 164 on Reader Service Card

Best news in years about Resinoid Wheels!

Norton Reinforced Resinoid Wheels — rigid and semi-flexible — have long been an unbeatable team for handling an almost endless list of weld grinding jobs.

Today, these weld grinding favorites are produced in the new Norton Worcester Plant No. 8 — five acres of the very latest facilities for grinding wheel manufacture — where quality control, always a key factor at Norton, is now as thorough as ultra-modern equipment and development can make it.

- *Norton BD and BDA rigid wheels, raised hub type, glass-nylon reinforced, are ideal for grinding medium to heavy welds, including stainless steel — and for smoothing flame-cut edges, notching, slotting and cutting-off.*
- *Norton BFR semi-flexible wheels, raised hub type, nylon reinforced, are fast and free cutting in lighter weld grinding, removing scale, blending contours, scarfing and beveling before welding.*

For further facts on the latest, most outstanding progress in weld grinding wheels — both the reinforced types and straight, cups and cones — see your Norton Distributor. Or write to NORTON COMPANY, General Offices, Worcester 6, Massachusetts. Plants and distributors around the world.

NORTON
ABRASIVES

W-1971

75 years of . . . Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

For more facts Circle No. 165 on Reader Service Card

Tack welding cast iron cones to carbon steel vortex tubes of gas scrubber. Ni-Rod "55" Electrodes make ductile, crack-free joints. Scrubbers made by The Aerotec Corp., Greenwich, Conn.

Weld cast iron to carbon steel...no preheat... no cracking...with Ni-Rod "55" Electrode

Joints were cracking up — between cast iron cones and carbon steel tubes in gas scrubbers like this one.

Welds made with carbon steel electrodes were just too brittle. They cracked when slag was chipped away. They sometimes broke entirely from rough handling in shipping.

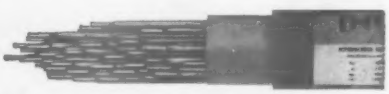
Then — Aerotec weldors switched to Ni-Rod "55"* Electrodes, specially developed by Inco for welding cast irons. And what a difference — no more cracked welds . . . no more preheating . . . good penetration. And Aerotec finds that with Ni-Rod "55", any weldor of normal skill can do a better job.

Get trouble-free welds between cast iron and ferrous or non-ferrous metals — with Ni-Rod "55" Electrode, available from most distributors.

You'll see a lot of ways other shops have pared costs in our booklet, "Repair Cast Iron Parts Quickly and Easily". Yours for the asking. *Inco trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
Huntington 17, West Virginia

INCO WELDING PRODUCTS



electrodes • wires • fluxes

For more facts Circle No. 166 on Reader Service Card

BETWEEN PASSES

put to good use

A Chicago importer of nuts and bolts has put them to good use — as a welded sculpture.

Pictured above, the 6-ft high abstraction is based on the Biblical story of the burning bush. The nuts and bolts are welded together in a flame-like arrangement of a burning object. The designer was Egon Weiner, a professor in sculpture at the Art Institute of Chicago.

He was commissioned to do the work by Heads and Threads, Inc., the import firm which plans to use the sculpture as a symbol of identity with its products.

theory of rust

Scientists at Westinghouse Research Laboratories have advanced a new theory about an age-old problem — rust.

Researchers Dr. Earl A. Gulbransen and T. P. Copan suggest that the true culprits in corrosion of iron are hydrogen ions, or protons — one of the basic building blocks of matter. The hydrogen ions come from water vapor, which must be present if iron is to rust to any great extent at room temperature.

Their theory suggests that the tiny hydrogen particles penetrate the iron and enlarge the sites at which oxygen normally combines with the metal. This spreads the reaction throughout the surface, causing it to rust destructively.

Until now, a standard explanation for iron corrosion is that it is an electrochemical reaction, somewhat similar to that which occurs in an ordinary battery. Tiny local areas on the surface of the metal are assumed to act as plus and minus electrical terminals under influence of an invisible liquid film of water, generating minute electric currents that corrode the metal.

Experiments at Westinghouse showed that with dry oxygen, the iron formed a protective oxide coating, but with hydrogen also present, the rust becomes a destructive force.

James H. Frazier, Jr.

awarded WE scholarship

The Welding Engineer Scholarship for Welding Engineering, established recently by this publishing company at Ohio State University, has been awarded to James H. Frazier, Jr., of Southfield, Mich.

This past summer Frazier has been working at the Jarvis B. Webb Co., also in Southfield. He returns to Ohio State this month to continue his education in welding engineering. Frazier will begin his junior year.

NEW

Mid-States Power-Tran

180 Amp. Welder

Farm Shop Equipment

★ **Wide Range**
15-180 Amps in 15 steps. Will weld light and heavy gauge materials. 1/16" thru 3/16" rod.

★ **Full 80 Volt Open Circuit Voltage**
Means you can weld with all types of rods — stainless, cast iron, hard surfacing, low hydrogen.

★ **5 Year Burn Out Proof Guarantee**
Proves high quality of components. Your assurance of the best welder available!

★ **Volt-Arc Balancing Net Work**
Voltage automatically adjusts for light gauge materials and gives dense, deep penetration on heavy metals.

★ **Color Coded Amperage Settings**
Simplifies current settings — accurate and positive values each time.

★ **Heavy Duty Wheels**
Highly mobile — Use it anywhere in the shop or barn.

★ **No Moving Parts**
Transformer designed for connection cooling — No fans that require oiling — no maintenance.

★ **Extra Bonus**
Built in "EYE APPEAL." Modern, attractive and follows the same design as the famous MAGNA-TRAN.

★ **Cam-Lok Plugs**
For positive fit — Can't pull out.

Built to NEMA, REA and UL Specifications for your protection

WRITE FOR CATALOG SHEET ABOUT OTHER FINE MID-STATES PRODUCTS

MS Mid-States Welder Mfg. Co.

6025 S. Ashland Ave. Chicago 36, Ill.

Circle No. 184 on Reader Service Card

SIMPLIFY LOW-TEMPERATURE SILVER BRAZING WITH THESE SPECIALLY DEVELOPED FLUXES!

The correct selection of flux can offer unexpected help in speeding and simplifying production, minimizing rejects and lowering costs in low temperature silver brazing operations. The advantages to be gained by "selective fluxing" are *sufficiently important to warrant careful, thorough study!*

Silvaloy offers the most advanced flux developments in this specialized field. Here, is *a complete line of fluxes* . . . each providing outstanding performance, enabling you to select the correct flux for every possible low temperature brazing operation. The extra efficiency of Silvaloy "Selective Fluxing" is being proved daily on the brazing production lines of the country's leading manufacturers.

Call the Silvaloy distributor in your area for consultation and detailed information or, send for our booklet "A Complete Guide to Selective Fluxing for Low Temperature Silver Brazing."

Silvaloy fluxes are packaged in 65-lb. and 30-lb. drums, 5-lb. wide mouth jars (5 to a carton), 1-lb. and ½-lb. jars. The wide opening of the 5-lb. package makes it a most practical, time saving dispenser that also enables the operator to make use of every bit of flux in jar.

SEND FOR THIS COMPLETE GUIDE TO FLUXING

ENGELHARD
INDUSTRIES, INC.
AMERICAN PLATINUM & SILVER DIVISION
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SEPTEMBER, 1960

Welding Engineer

ESTABLISHED 1916

A welding jackpot

IN ONE WEEK OF STUDIED COUNTDOWNS, the United States, through its various agencies, managed to collect an impressive jackpot of space-age achievements. Items:

¶ The X-15 experimental aircraft climbed to a record altitude of 131,000 ft after streaking a record 2,200 mph earlier the same week.

¶ The Atlas ICBM raced 7,000 miles down the Atlantic range to land on target off the African coast; the second longest shot on record.

¶ The Discoverer XIII instrument capsule was ejected and retrieved for the first time after 17 polar-orbiting trips by the satellite.

¶ The 10-story-high Echo I balloon was placed in orbit and used as a radio-wave relay.

Amazing, though not fully understood by most of us, these contributions to scientific progress carrying "Made in USA" labels swell us with national pride.

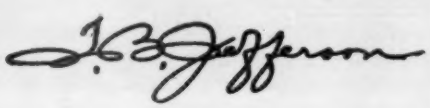
And we in the welding industry can take a special pride in these achievements — since without welding they could not have been done.

Some look down their collective noses at welding, but we need not take a backseat to anyone. Welding's contributions to a better way of life are easily pointed out; yet this is where so many of us fail.

Evidence of these contributions is all around; if not in space, then in our own living rooms. Even that magic, one-eyed box called television owes much to welding. Welded filaments in the electronic tube; the glass screen welded to the steel picture-tube shell, the welded chassis — all essential to a well-functioning TV set.

Welding is there at every turn. Unfortunately, those unfamiliar with this modern means of joining materials do not recognize its importance. It is every reader's job to boast about welding's improvement of our way of life.

In selling welding, you will also be selling your company's products. You cannot start selling welding too soon; and in this case, it is never too late.



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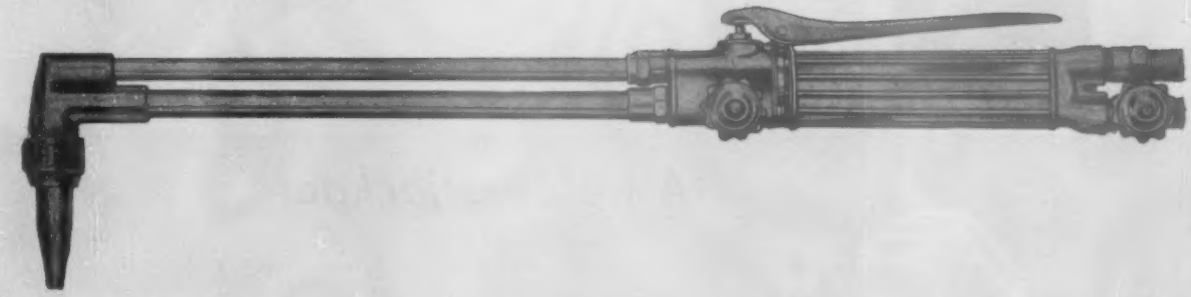

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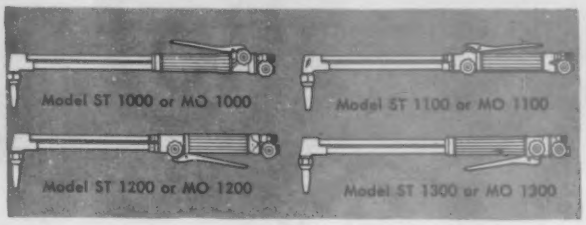

LENGTHS: 21", 27", 3' and 4'. (Special lengths on request).

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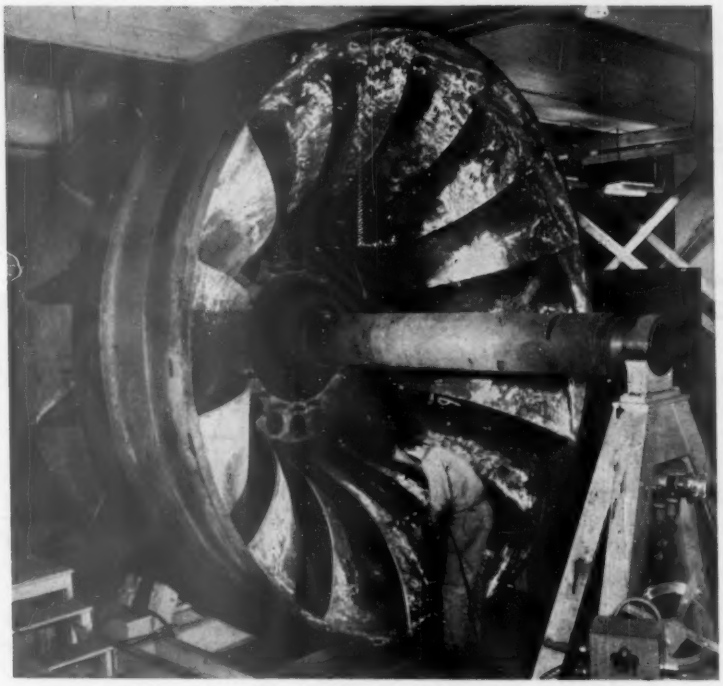


PORTABLE Mig welder, operating on d-c reverse polarity, deposits stainless steel surface on huge turbine blade to combat cavitation at Canadian power plant.

by R. R. MacDonald
District Manager
Linde Co.

Stainless steel overlay increases turbine blade life

CAVITATION DAMAGE, the pitting of metal turbine blades due to the action of water, is a strange phenomenon.

Even today, science is none too sure of its cause (see boxed material at right). But one thing is known—its deteriorating effect on hydro-turbine blades is extremely costly.

Some years go, The Hydro Electric Power Commission of Ontario, Canada, found that this damage could be diminished by depositing a thin layer of stainless steel on the affected areas of the blades.

Mig welding was selected as the fastest, most economical means of depositing these quality coatings. Argon shielding protects the weld area from contamination, while the consumable wire electrode overlays the blade with a hard, dense stainless steel surface.

Using a portable Mig unit, Ontario Hydro performs all welding inside the power house. In some cases welding is done without removing the huge turbine blades from their positions. (Overhead welding techniques are used to eliminate turbine dismantling.)

The cavities are first filled with a carbon steel deposit using a 1/16-in.-diameter wire; surface cladding is then completed with type 301 stainless steel wire. The bronze turbine runner blades are also rebuilt, using a copper-silicon alloy wire.

Service life of these turbine blades has been doubled, with no evidence to date of any major recurrence of cavitation.

Is cavitation caused by bubbles?

ONE THEORY, soon to be tested, might be the answer to this problem of turbine cavitation.

Martin Friedmann, a welding contractor from South Norfolk, Va., maintains that electrically-charged water bubbles are at the heart of this decay or pocking of steel in turbines.

Some engineers have contended that cavitation is a purely mechanical occurrence. Friedmann, on the other hand, states: "I noticed in working on these turbines that the cavitation always occurs behind the point of greatest impact."

If cavitation were caused by sheer mechanical force, the greatest pitting would occur at the point of greatest impact. The culprit, according to Friedmann, is a damage-causing electrical action, *viz.*, air bubbles in the water build up an electrical potential.

"It is a cathodic action due to the velocity of the water," explains Friedmann. "The air bubbles, seeking a charge, destroy the grain structure of the steel."

As a possible solution, he proposes to inject a positive charge into the water to counteract this cathodic reaction. The first test will be in a Duke Power Co. dam in South Carolina.

Friedmann's theory has been presented previously in trade journals and he has received inquiries about it from all parts of the world.

by Nicholas S. Hodska
Design Engineer
Sikorsky Aircraft Corp.
Stratford, Conn.

Welding heat is chief factor in determining weld quality

WELD QUALITY DEPENDS chiefly on welding heat for all of its strengths and weaknesses, its consistencies and failures.

Simply defined, welding heat is the degree of ambient heat necessary for any metal joining process used in making welds. Yet as new methods, materials and electrodes are designed, design engineers are usually unaware of the heat balance effect when welding the base metals.

If the base metal ends are insufficiently heated, they will not unite, and conversely, if the work is exposed to a higher temperature too long, it becomes overheated, burned, and the metal is greatly weakened. Hence, strict attention must be given the effects of the welding arc or flame on the structures and properties of metals being joined.

Prolonged heating is detrimental to any metal. For example, ordinary iron when overheated appears rough, full of voids, and in some cases, is subject to vapor pressure (the tendency to pass into gaseous form) by the arc's intense heat.

An overwhelming air blast and fire-oxidation are the most dangerous types of heating hazards. Therefore, a substantial safety margin should be added to insure slow heat application to obtain a uniform temperature in every respect.

On the other hand, rapid heating of a part can produce defective welds. The exterior may be raised to the proper welding temperature, while the interior structure is well below it.

Since organized welding entails localized heating of the base metal in an area adjacent to the weld, which is subsequently cooled rapidly, cooling is especially drastic on the first pass during welding of heavy members and/or sections.

Consequently, in order to make a good fusion weld and still have the metal a short distance from the weld moderately cold, it is essential to use the proper flame or other heat source.

In initial part design, it is the designer's responsibility to control the sectional members of structural parts within specific limits, so they are capable of being welded with a minimum of passes. Once a part, machine or machine base has been designed and built, the best welding technique cannot hide a poor design.

Reliability studies show that defective welds occur, despite proper preheating, welding technique and stress relief, because of (1) inadequate weld rating specification, (2) inherent defects of the base metals, (3) operational abuse, and (4) underdesign or inadequate weld metal deposits.

The need for adequate welding specifications and ratings is not appreciated by many design engineers. Often the so-called "safe-heating" operating condition specified for the base material will subject the part to excessive stresses and lead to early failure.

Very few specifications or ratings for welds can be used directly in the design of a machine or experimental model. Usually, the designer must interpret his welding data in the light of his experience.

In preparing base metal for fusion welding, it is conceivable that irregular low temperatures may constitute brittle zones. Uncontrolled heat in the material may lead to unpredictable parameter changes or instabilities in any weld. The status quo cannot be maintained against a questionable weld; invariably it limits service life and reliability.

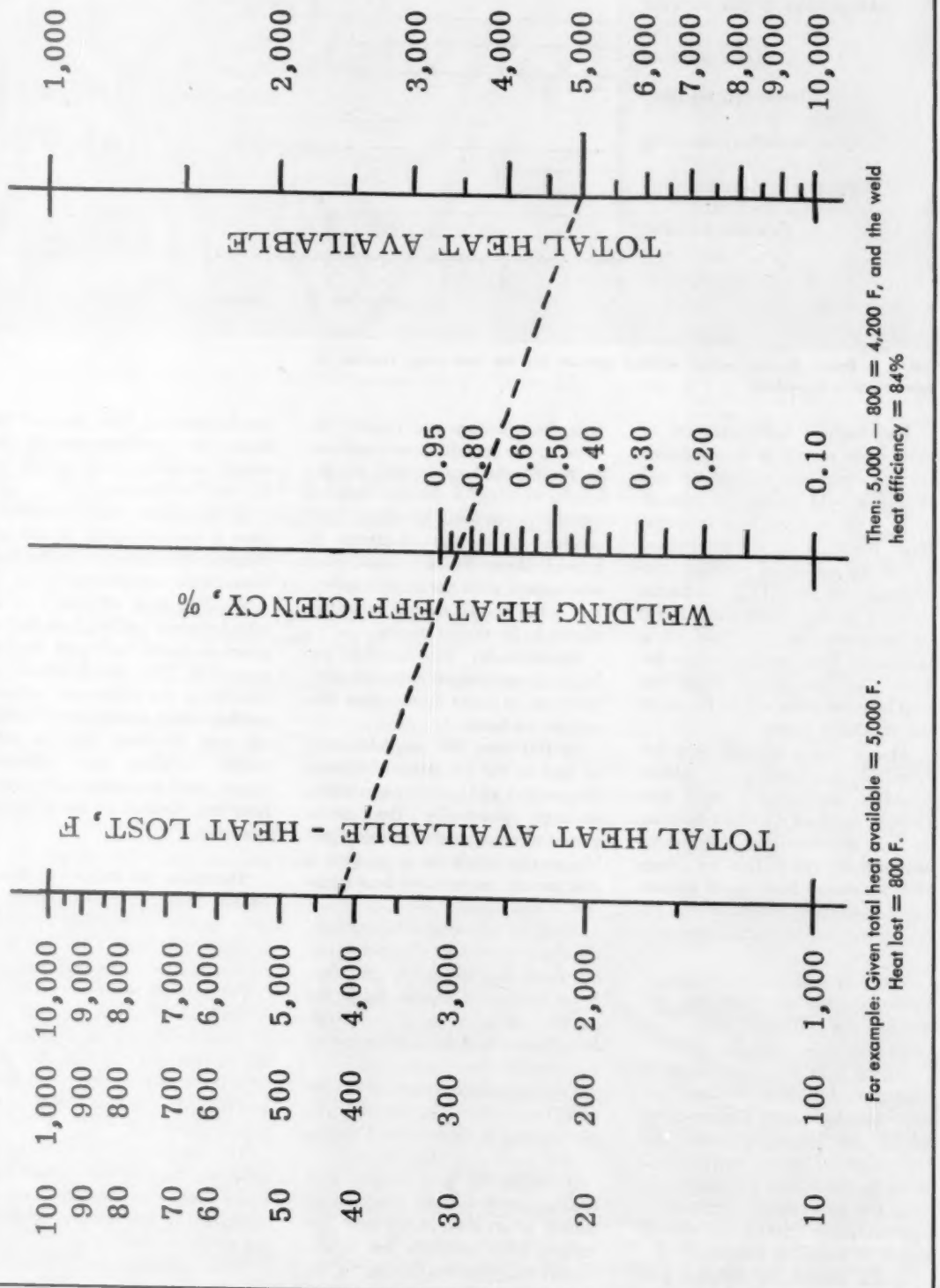
The load-carrying capacities of basic metals vary according to characteristics of the material (such as weld strength), the design application, and the nature of the loads to be accommodated.

Weld standards for rating the load-carrying capacities provide a universal method of comparison for welding conditions. However, these standard ratings are on the optimistic side.

They are based on mechanical properties and penetration durability, and do not take into account thermal limitations of the weldment. Exercising care, the design engineer or supervisor can use these ratings as specified (unless he is trying to exploit a base metal to its fullest capabilities).

Designers often overlook the significance of a rise in welding heat beyond the case temperature of the part being welded. Gas welding of thin-walled aircraft tubing is an example. Sufficient alloy is "picked up" from the base metal to bring the weld metal's strength up to requirements. However, with large welded structural members, strains may occur even at lower temperatures and finally lead to fatigue.

Determining weld heat efficiency



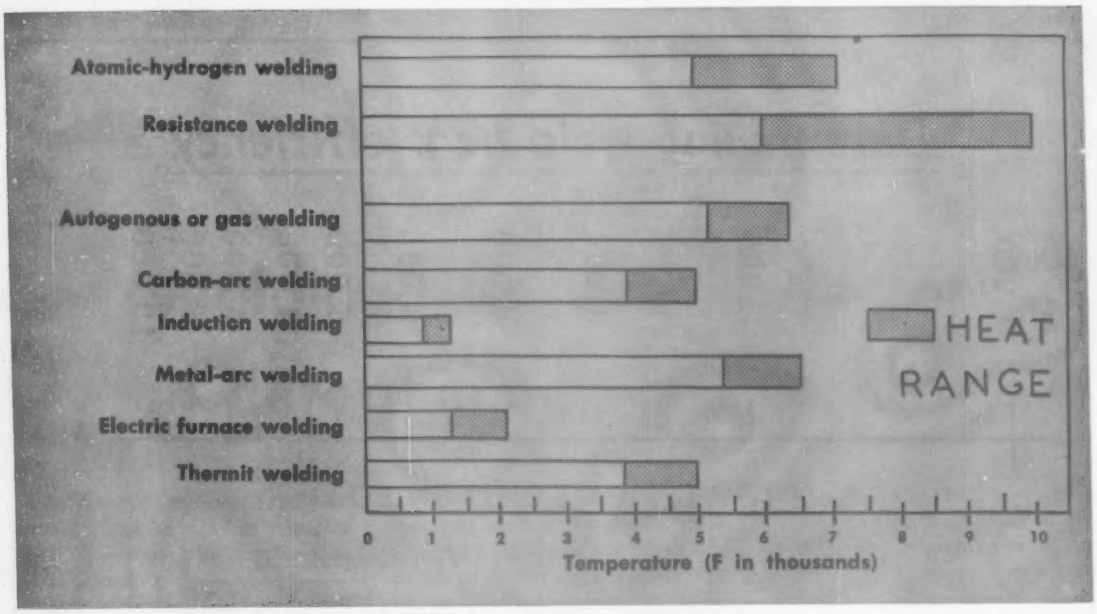


FIG. 1 — Graph showing various welding methods and the heat range required for base metals to be welded.

The thermal time constant of most basic metals is short enough for the electrodes to heat up and deposit a weld during the average cycle. Two welding heat temperatures, therefore should be defined before an industrial welding machine is set up: (1) a maximum welding heat temperature based on parameter stability, and (2) a maximum heat concentration between two base metals. Often this heat concentration will be the limiting reliability factor.

At any rate, a welding heat differential specification is seldom found in conventional weld data ratings, nor does it always show up in heat concentration tests which are normally run to find the allowable maximum base metal operating temperature (based on the extreme heat concentration applied).

The only safe way is to run periodic temperature tests designed to produce efficient weld heat ranges.

Figure 1 is a typical graph as suggested by most welding machine manufacturers. Ranges covered by the various processes are dependent on the welding methods used. In the atomic hydrogen process, the temperature produced is approximately 7,200 F and enables metals to be fusion welded.

In the carbon arc welding process, heat ratings are usually related to the specific base metals or to the specific heat applied, whichever is limiting. A uniform forward motion is required to obtain best results; either the electrode is moved along by a motor-driven mechanism, as in the aircraft industry, or the work is moved under the electrode by similar means.

Occasionally, the correct arc length is maintained automatically; however, in many applications this is done by hand.

In this case, the recombination of ions in the arc stream between the positive and negative electrodes undergo practically the entire gamut of changes within the possible energy levels so as to give a continuous concentrated heat emission. (See figure 2.)

Thus, at ordinary temperatures, air will not conduct electricity, but the flash that occurs as the electrode touches the work heats the air at that point to a very high temperature and vaporizes some of the metals. (See figure 3.)

This vaporized metal forms the path to conduct the current. An electric arc is then formed and a pool of molten metal produced.

If heated in these electric arcs (and because of their low melting points) many base metals may operate at such relatively low or abnormal temperatures that in the recombination of their ionized particles, the readjustments of their energy levels to receive weld metals are less numerous.

In these cases, the arc appears to have a pattern which is not continuous, but rather a predominant intermittent application.

Welding heat efficiency is the ratio between welding heat that appears as useful work and the heat expended. The useful effect, obviously, is the difference between available heat, or total heat expended, and the heat lost. In other words, welding heat efficiency equals total available heat, minus heat lost, divided by the total heat available.

Therefore, the value will always be less than 1, *i.e.*, the efficiency of a welder or welding operation is always a decimal. (See data sheet nomogram on preceding page.)

For example, if welder efficiency is 0.85 or 85%, this signifies that of total welding heat supplied by the electrodes via the welder, only 85% is converted into useful effect and reappears as heat energy in the vapor generated.

The remainder, or 15%, represents the total of the various heat losses that occur, and the amounts dissipated or lost without performing useful welding work.

When welding heat is produced

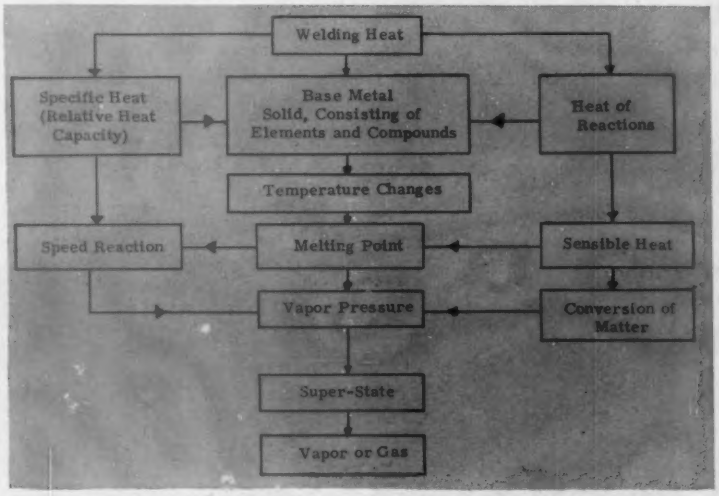


FIG. 2 — Schematic layout illustrates the application and reaction of welding heat to a base metal.

by any basic welding process, the following losses are present: radiation, conduction and convection losses; losses due to the character of the welding process; and losses due to the differences of the temperature involved.

The intensity and extent of physical changes brought about by unavoidable heat losses accompany the execution of every weld. Thus, considerable attention must be given to the unique heat transfer phenomena associated with the movement and losses of heat sources ambient to, and surrounding, metal surfaces.

When flame-cutting, the preheating temperature will vary, depending on the composition and size of the plate being cut. If the part is preheated to about 500 F, and subsequently heated to 5,000 F, only that amount of heat between the two temperatures can be transmitted to the work.

The remaining heat, represented by the temperature difference between 500 F and atmosphere temperature, is generally unavailable for the operation and is rejected as sensible heat in the vapors formed by burning of fuel gases.

An asbestos-paper covering is frequently used to confine heat to the subject metal. This covering is usually surrounded by relatively cool atmospheric air, which in turn receives heat from the plates by radiation and convection.

Air moisture entering the welding heat area is evaporated and the heat thus expended is lost to the atmosphere, carried away by the super-heated vapor produced.

The foregoing heat losses cannot be completely avoided; they can only be reduced to a certain minimum. Thus, it is important to avoid large temperature differences between the outside surface and the base metal interior, since they upset heat concentration uniformity.

The only medium that will insulate against conduction heat loss is a vacuum. However, it will not prevent radiation heat loss. Asbestos will conduct heat more slowly than other insulations, and is thus valuable for welding various pipes, tubes, plates and bars.

There is no doubt that a long term development program should be started now to meet the heat control needs of future welding operations. We must strive for greater technical welding advancements.

Such a controlled welding program might undertake the following:

(1) Develop a heat control flow system for all present types of welding machines to extend and control their welding heat range to over 10,000 F.

(2) Develop a portable electronic machine that could be used to check the "nominal chemical range" in iron or steel parts, to be utilized in the field or shop. From the instrument readings, weldors could select the proper electrodes.

(3) Apply a combination of electrical and mechanical concepts for accurate control of the heating operation and to improve existing welding systems by measuring what the temperature of the work is, what it should be, and then automatically compensate for variations.

(4) Study, develop and test different induction heating units and welding systems that would be capable of operating at temperatures and conditions comparable to outer space or moon atmospheres.

(5) Explore the possibilities of welding rare metals, using exotic gases or unique electrodes, capable of extremely high temperatures for sea and underwater welding operations.

(6) Form a central source or agency whereby heat data, ratings and records are maintained on basic thermal conditions as they exist during and after welding on all types of metals.

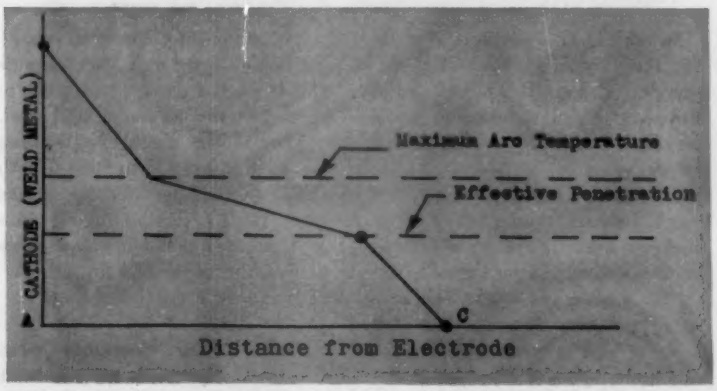


FIG. 3 — The carbon arc showing its positive temperature and voltage gradient. With straight polarity, the greatest heat concentration is at the electrode (cathode) tip.

Welded Wheel Excavator moves earth far and fast

FIRST Wheel Excavator was built five years ago and is now in use at a Truax-Traer coal mine near Fiatt, Ill. Unit closely resembles newest excavator scheduled to go into operation at River King Mine next month.

by **Otis Young**
Metal & Thermit Corp.

ONE OF A NEW BREED of large-scale earth-moving machines utilizing the wheel in place of a shovel will begin stripping up to 1.5 million cu ft of overburden per month in early October.

This 1,500-ton Wheel Excavator with its prodigious appetite for sand and dirt was fabricated predominantly by welding by Bucyrus-Erie Co., South Milwaukee, and will be used at Peabody Coal Co.'s River King Mine, Freeburg, Ill.

It is the second such unit to be built by the company and only the third of its size in this country.

In coal field operations, such as the Peabody one, the Wheel Excavator is teamed with a large stripping shovel to uncover veins previously considered impractical for stripping.

The "wheel," rimmed with nine tough, abrasion-resistant digging buckets, cuts into unstable overburden normally occuring near the top of a mine cut bank. The material is deposited more than 380 ft away via a conveyor system which eliminates the swiveling operations of a shovel-type unit.

A stripping shovel, following the Wheel Excavator, places the more stable material from the lower part of the bank at the bottom of the spoil pile where it acts as a "buck wall." In essence, the Wheel Excavator provides an economical, fast, continuous flow of unstable overburden over a greater distance than previously possible.

Two types of steel were used almost exclusively for the machine. The superstructure, including such units as conveyor ladders and booms, was fabricated from high-strength, low-alloy Tri-Ten steel to provide as much strength with as little weight as possible.

The supporting base and revolving frame for the unit, which stands 160 ft high from ground level to boom top, were made of mild steel.

Manual a-c metal-arc welding was used in more than 80% of both shop and field welding operations with E7018 low-hydrogen, iron powder, all-position electrodes playing the major role in both Tri-Ten and mild steel welding.

Some E8018 electrodes were also used. Diameters ranged from 5/32 to ¼ in. with the smaller diameters used for field welding. Metal & Thermit Corp. was a major electrode supplier.

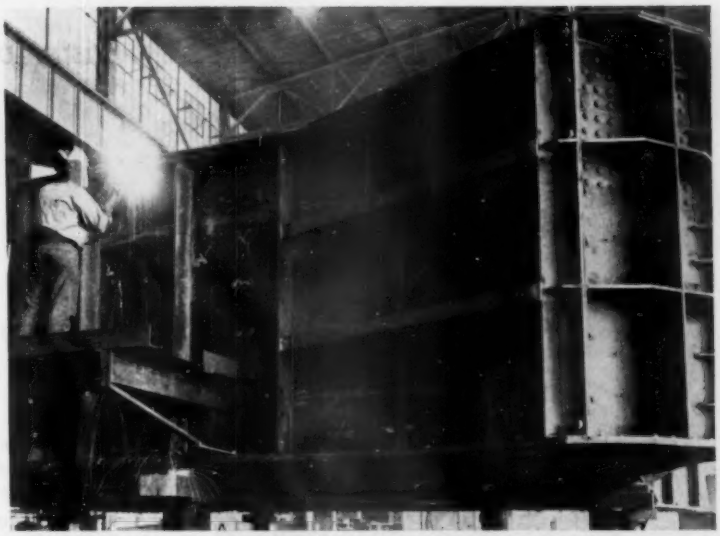
Comprehensive performance tests proved the suitability of E7018 electrodes over E6012 electrodes for this particular application. Welds were crack-free and welding was steady and easy to control.

Manufacturer's recommendations were followed for amperage and voltage, and the settings were

checked daily with tong meters.

Submerged-arc welding was utilized where possible on large girder sections of mild steel base section. The base, measuring approximately 50 ft square and 8 ft high, is a standard model used for most of Bucyrus-Erie's large shovels.

Motive power for the Wheel Excavator is supplied by four electrically driven crawlers mounted under each corner. Hydraulic jacks provide leveling when necessary during operation.



EXCAVATOR base is welded using E7018 electrodes in overhead position. Unit measures approximately 50 ft square and 8 ft high, weighs 40 tons. Mild steel plates ranged from 1½ to ½-in. thick.

Four solid bridge-type girders, braced at the ends, top and bottom to connect with the diagonal members, form the perimeter of the base. Diagonal structural members are heavy box-section, bridge-type girders extending through the corners formed by the side girders providing the effect of "walled in beams."

Through a special center design, a continuous girder effect has been achieved. Corner castings are welded and bolted to girders. Four full-depth girders extend from the center of the base to the center of each side girder.

Outside girders were fabricated from 1½-in. mild steel plate while ¾-in. plate was used for the box sections. Metal-arc welding was the predominant fabricating method for the box sections. Submerged-arc was used only on the large girder sections.

The 60-ft revolving frame section, supporting the main truss as well as swing machinery units, digging ladder hoist machinery, stacker ladder hoist machinery and other electrical units, consists of Tri-Ten plate and Tee sections joined by manual metal-arc welding.

Plates ranged from 1½ to ½-in. thick. There are two welded longitudinal box side sections, three welded center sections fitted in place between the side sections and transverse tie girders across the front and rear of the unit.

Other major welded units include the main truss, digging ladder gantry, stacker ladder gantry, the 315-ft stacker conveyor, the 70-ft digging ladder and the wheel housing.

Fillet weld sizes range from ¼ to ½-in. and most welds required at least two passes. Butt welding also figured in fabrication plans. Plates were prepared by oxypropane flame-cutting; edges were cut to a 45 deg included angle on both sides for thicker sections.

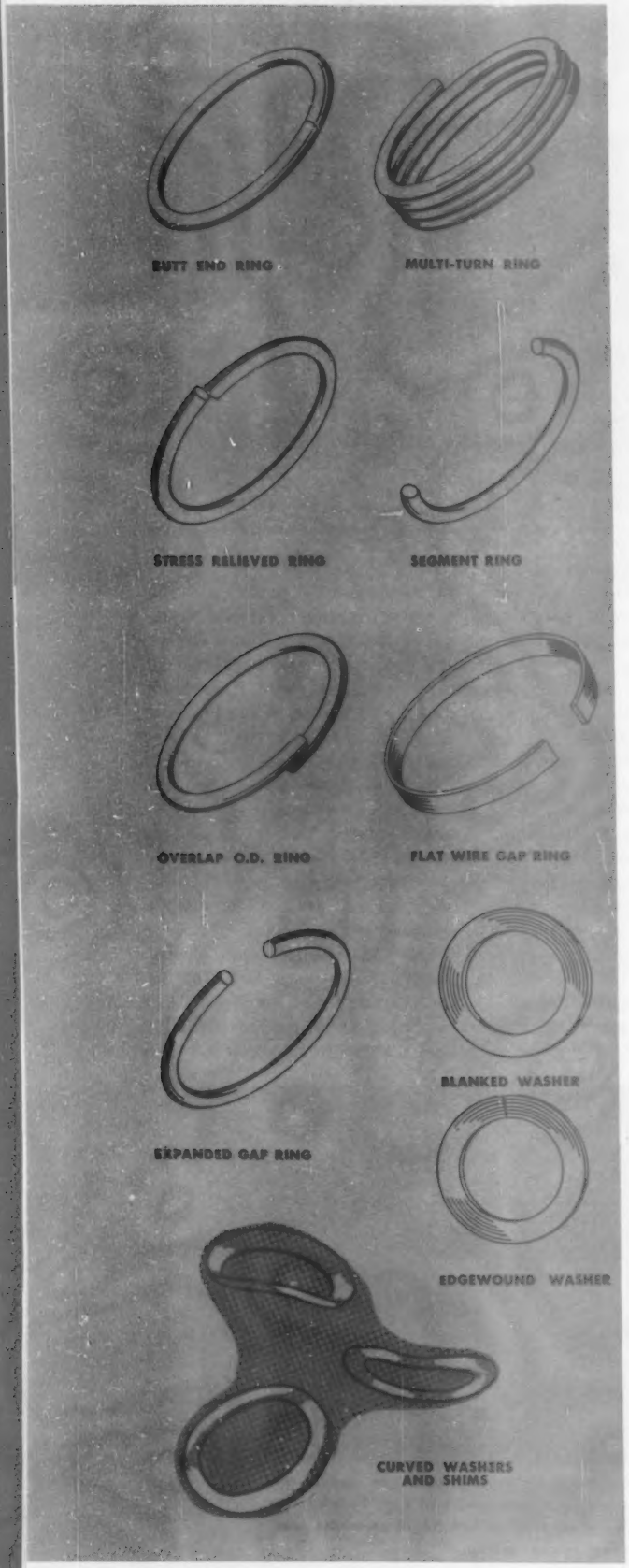
In shop fabrication, extensive use was made of overhead cranes to position all sections for downhand flat welding where possible. Preweld heat treatment was not necessary, but certain mild steel and Tri-Ten steel sections were stress relieved in a gas-fired oven with a maximum physical capacity of 10 by 30 ft.

Field welding was supervised by Bucyrus-Erie. Approximately 20% of the welding on the base was done in the field; less field welding was necessary for the superstructure. Most outside welding was done in the summer. However, some operations were carried out during the winter, requiring heated enclosures when the temperature fell below freezing.

In general, quality control was handled by visual inspection methods. Magnetic particle inspection was used in specialized instances. Weld cracking and porosity were never serious problems throughout the year-long project.

Upon completion next month, the Wheel Excavator will stand as another large and impressive example of what welding can do, both effectively and economically.

TRUNNION frame for digging ladder, as well as all superstructure parts, was fabricated from Tri-Ten steel. Manual metal-arc welding with E7018 electrodes was the dominant joining method.



- *Faster production*
- *Reduced costs*
- *Uniform quality*

How to

SPEED PRODUCTION, reduce and standardize costs, and obtain uniform results of high quality in brazed products — this is the threefold purpose of automatic brazing operations.

And to help achieve and maintain this goal, the brazing preform, of necessity, was developed.

It is impractical and usually impossible to handfeed brazing alloy to the stream of parts emerging from a conveyor belt furnace, gas-air turntable, or to work inside the induction coil.

Preforms also provide other advantages: economy in amount of alloy used, savings in labor, better product appearance, minimum rejects and easier visual inspection.

Virtually all high production applications requiring a brazing or soldering alloy (whether silver, copper, brass or lead) can be designed to make use of these advantages.

There are different types of preforms, each more adaptable for particular applications. Their intended use, in turn, determines their selection.

Those joints best suited to withstand impact and fatigue are also those which best lend themselves to silver alloy preplacement. These are designs which provide either external or internal shoulders.

The shoulders give positive location which eliminates elaborate fixturing. More important, they usually eliminate points of high stress in two planes.

The preform should be hidden or trapped between members. When this can be done, the alloy will flow through the joint despite any differential in heating, and will give visual assurance of penetration.

However, when this cannot be done, the heat should be applied to the side of the joint opposite the preform and both members heated as evenly as possible to pull the alloy through the joint.

The low-temperature brazing alloys commonly used have little alloying action with parent metals, thus, permitting use of slugs, ring segments and other forms for ease of assembly.

Capillary action will pull the alloy throughout the joint. A preform surrounding the joint will yield a more even fillet, and even the abbreviated forms will give good brazing results.

Silver brazing alloys provide minimum shear

by **Harlan Olson**
Vice President
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design for preform brazing

strengths of 25,000 psi. Joints of excessive shear depths waste alloy, complicate heat conduction, slow production and create oxidation problems.

When excessive shear depths are inherent in the design, it is wise to put the rings near the joint ends and pull the alloy to the outer seams.

To detail all joint designs is impossible. But from the following, the designer or engineer should be able to translate the basic idea to his specific application. In every case, try first to hide the preform; failing that, apply the heat on the joint side opposite the perform.

The easiest joints to locate and preform are those providing shoulders. This can frequently be done by counterboring the female members. A washer is the ideal preform, since it requires the least displacement (figure 1).

A blanked washer is favored for small diameter joints; the edgewound for large diameters. Where wall thickness permits chamfering the male member, a ring can be hidden in the chamfer and little or no displacement is required (figure 2).

It is also possible to drop a ring down to the shoulder and permit the parts to settle. However, alloy may squirt into the ID if displacement is rapid or cocking may occur where the fit is tight.

If the male member is a screw machine part or a long joint is involved, grooves can be machined to take rings (figure 3). For large diameter joints, the ring will usually have enough elasticity to go over the part and then snap into the groove.

In the case of small diameter joints this will not be true and a 250 deg arc ring should be pushed into the groove from the side. Where a groove is desired, but wall thickness will not permit the necessary volume of round wire, a flat wire ring will provide more volume with less sacrifice of the wall.

It should be pointed out that complete joint pene-

Types of Brazing Preforms

Butt-end ring. The common loose ring which snaps over parts or drops into holes onto an internal shoulder.

Stress-relieved rings. Small rings seldom open much with heat, but larger rings that are not confined on the OD will distort considerably. The stress-relieved ring eliminates this problem.

Overlap OD ring. The ring used for positive location inside of tubing. Better than a loose gap ring since it will not tangle and the ends never interfere with each other. The OD is specified as 0.010 larger than the ID of the tubing.

Expanded-gap ring. The ends are gapped by heat treatment and when in position, the ends are closed. Used for internal grooves and for larger tubing than the overlap OD rings.

Multi-turn ring. These can be used as an overlap OD ring where faster melting is desired. Also to provide more volume than in a one-turn ring.

Arc or segment ring. These have basically two uses: (1) To go into grooves from the side when the ring would distort if pushed over the end of the part — usually 250 deg. (2) For pierced tubing joints that must be made in such a position that a full ring collects too much alloy at the bottom of the joint — usually 210 deg.

Blanked washer. For small joints requiring a washer or whenever thickness must be held to a minimum.

Edgewound washer. For larger joints requiring a washer. Since it is formed by winding flat wire on edge, no scrap is generated and no dies are required. Minimum thickness is 0.010 and as wire width increases from 0.062, thickness must also increase.

Coined washer. Formed by coining a ring. Particularly suitable for small washers of 0.010 thickness or heavier, and quantities of 10,000 and up. The advantage is the absence of scrap and dies.

Curved washer and shim. Not a common preform, but sometimes required for tubing joints where matching the tube curve speeds assembly.

tration is seldom necessary on long joints to achieve the desired strength. Grooves should be placed near the outer seams to avoid excessive heating and to minimize the alloy cost.

Another desirable joint design is the external shoulder. Again, this provides location and, if wide enough, a place to trap the alloy. A washer minimizes displacement.

If a large fillet is needed for appearance, or to avoid a sharp change of section, the OD of the washer should extend beyond the male member's OD (figure 4). A ring can also be used and the heat applied to the opposite side of the joint (figures 5 and 6).

In figure 5, if heating is uneven, the alloy may plate out on the flat member. In figure 6, a chamfer should be provided to lead the alloy into the joint.

A design frequently encountered on hydraulic cylinders and ordnance items is shown in figures 7 and 8. When heating is slow, the inside ring (figure 7) is good and appearance of the alloy is assurance of joint penetration.

However, when heating is rapid, as with induction or high-speed gas, the sharp outer corners may oxidize before heat conducts to the ring. Then an edgewound washer (figure 8) will melt along the corners, protecting them from oxidation, and heating can continue until the desired penetration is achieved.

Brazing is one of the best and fastest methods of joining tubing. The following are typical designs:

Tee-joint (with no hole in the horizontal member). The vertical member is radiused to mate with the horizontal. Slugs or balls can be dropped down the tube, but an overlap OD ring (figure 9) is usually recommended instead.

The OD should be slightly larger than the tube's ID so that when pushed in, it stays in position. The overlapped ends will adjust for tolerance variation.

Tee-joint (with same ID hole as vertical member). An internal ring will not work, and to avoid an exposed ring, a washer is necessary (figure 10). However, a flat washer is awkward to assemble, especially if more than 0.005-in. thick.

A curved washer (figure 11) radiused to the horizontal member's curvature helps to avoid this problem. On saddle joints (figure 12) a curved shim is frequently snapped onto the tube and the saddle shape set down over it.

Pierced Tee-joint. This design is not desirable because the only solution is an exposed ring. When it is necessary, the best solution is to jig the assembly at 45 deg (figure 13) and use a half-ring.

By heating below the tube, the heat conducts up to the ring and an even flow is obtained. One solution is to bump the tube out and put the ring under the bulge (figure 14).

Return bends. Joints on air-conditioning coils and other heat exchangers (figure 15) must be made rapidly. The multi-turn ring, usually 1¼ or 1¾ turns, has

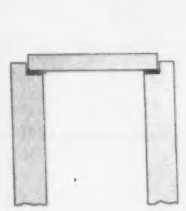
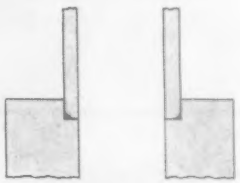


Figure 1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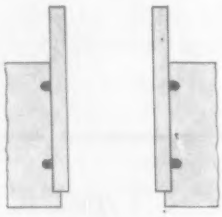
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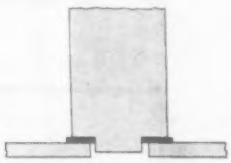
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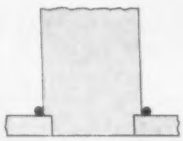
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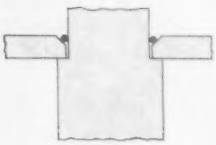
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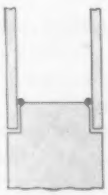
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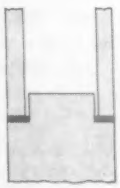
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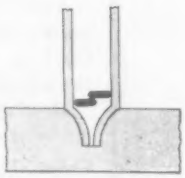
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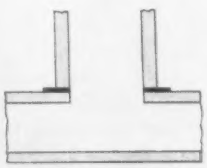
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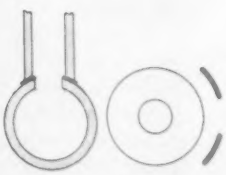
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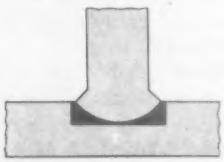
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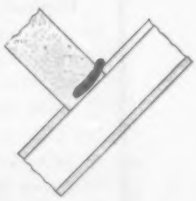


Figure 13

worked well. It holds tightly against the wall, does not swivel and adjusts readily to the sloping shoulder at the base of the expansion.

Putting the proper volume into a greater length of smaller wire results in faster melting than in a one-turn ring.

The above joints have dealt with thin wall tubing; Tee-joints of heavy wall tubing present other possibilities. Inlet and outlet fittings of hydraulic cylinders and heat exchangers are typical.

Spot facing or counterboring avoids the expense of milling a radius on the fitting, provides machined surfaces free from oxide plus a better design for impact resistance.

The last point can be very important. When a fitting is radiused and there is no support for the side walls, a hard impact (*e.g.*, a dropped cylinder) can place a high stress concentration at one point.

This may fracture the joint (figure 16). Spot facing (figure 17) provides wall support at the point where stress concentration will be highest. Since these fittings are usually large, an OD edgewound washer for spot faced assemblies and shims for radiused assemblies are recommended.

Similar joints are encountered on smaller assemblies, such as plumbing fittings and screw machine bodies for valves, etc., (figure 18). These should be counterbored to receive the side tubes and a washer or ring dropped into the counterbore.

The important point is to avoid the exposed ring as it runs down the side and not into the joint.

Capillary tube joints. A great many electronic devices and bulb thermostat assemblies use small diameter tubing. Frequently it is impossible to wind a ring to the ID and wire-diameter desired .

An example is 0.040 ID by 0.015 wire; but a 0.040 ID by 0.010 wire by 2½ turns can be made and will supply the necessary volume (figure 19). Also, the multi-turn ring will not tangle. If a small ID of one turn is demanded, a blanked washer is better than the ring.

Pierced joints. It is impossible to eliminate all pierced joints although the effort should be made. When such are inevitable, the following may help.

On thick-gage metal where the hole has been drilled (figure 20), a chamfer or counterbore should be provided for the brazing alloy. The chamfer serves primarily as a well for molten alloy and need not be so large as to submerge the ring.

On thin-gage metal holes are usually extruded to provide more brazing surface. The radius formed serves the same purpose as a chamfer (figure 21). A snap-ring tight on the tube will stay in position. Heat should be applied from the opposite side.

Contact joints. A wide variety of circular joints can be handled with square shims or washers.

A circular disc joint may be made more economically with a square shim (figure 23). Where a small lead is provided for location, a square washer accomplishes the same thing (figure 24).

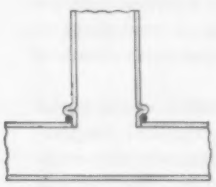
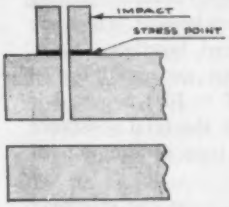


Figure 14

Figure 15



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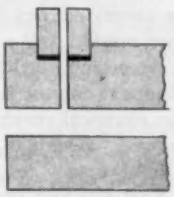
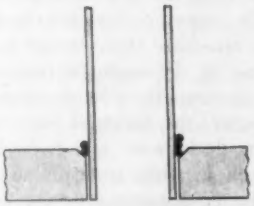


Figure 17

Figure 18



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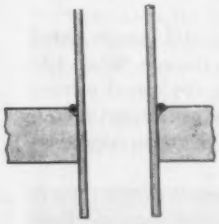

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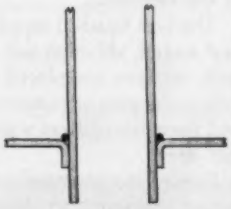

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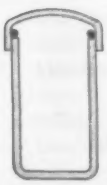

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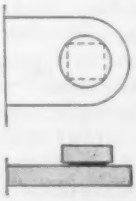

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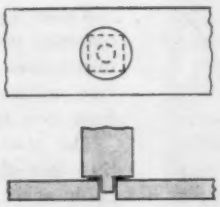

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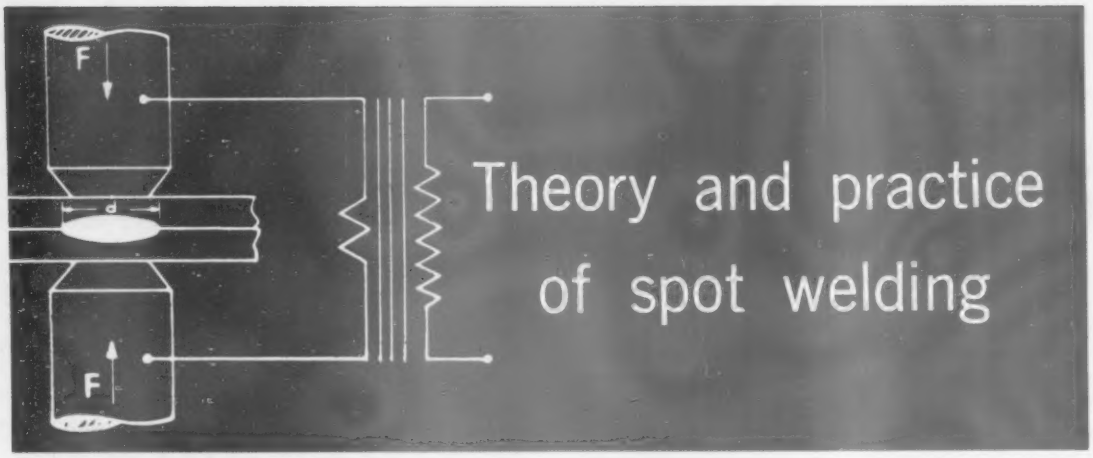

Theory and practice of spot welding

by **Douglas D. Williams**
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PROBABLY THE FIRST resistance welding was done by the village blacksmith. He heated his metal parts, then forged them together with hammer blows.

Now the required heat can be obtained by passing an electric current through the workpieces, which are then pressed, rather than hammered, together.

According to Joule's law, heat generated by an electrical current is stated as: $H = RI^2t$, where I is the electrical current in amps, R the total resistance between electrodes, and t the time or duration of current flow.

Spot welding depends primarily on the relatively higher electrical resistance of the junction between two plates, as well as the shape, size and composition of the electrodes.

The best finished metal surface is still heavily pitted and scored, although not visible to the eye. When two such surfaces are placed together, the actual contact area is the sum of numerous contact points and ridges, and therefore, differs widely from the theoretical contact area.

Hence, any junction between metals offers a much higher resistance to electrical current passage than the metals themselves. And consequently, more heat is generated here than in the surrounding metal.

With the welding pressure correctly controlled, as well as the intensity and duration of current, a satisfactory spot weld will be formed.

The actual value of resistance between two metals will, of course, vary with their hardness, conductivity, elasticity and freedom from superficial impurities. Temperatures, pressures applied and manner of application are also governing factors.

The application of pressure reduces contact resistance simply by overcoming elasticity and crushing or levelling surface irregularities. Rises in temperature achieve the same result by reducing the hardness of such irregularities.

However, for every metal there is a critical pressure above which the contact resistance of two plates of given thickness will remain constant with constant temperature.

Total resistance between electrodes is made up of three separate components: Ra (resistance of the junction between workpieces); Rb (resistance of the workpieces themselves); and Rc (resistance of the junction between workpieces and electrodes).

The first, Ra, is always greater than Rb. But it is equally important that Rc should be kept to a minimum, otherwise there would be a risk of electrodes burning or deforming during welding.

To illustrate the relative values of these components in practice, two sheets of clean, cold-rolled mild steel, 0.04-in.-thick, were spot welded under a pressure of 1,100 lb between truncated copper-alloy electrodes, 0.18 in. in diameter.

The values of each were: Ra — 178 microhms; Rb — 7 microhms; and Rc — 30 microhms.

Tables 1 and 2 show the contact resistance values obtained when sheets of cold-rolled mild steel and unstabilized 18-8 stainless steel were placed in contact at room temperature under varying pressures from two different copper-alloy electrodes.

The stainless steel's contact resistance is higher than that of mild steel due to its greater rigidity and hardness of surface irregularities. However, resistance between electrodes and steel sheets is less than between the sheets themselves because of the softer

Contact Resistance

Force lb	Plate A Electrode A	Plate A Electrode B	Plate B Electrode A	Plate B Electrode B
440	94	56	141	107
880	40	28	71	64
1,320	20	18	41	41
1,760	13	10	26	24
2,200	7	6	14	14

Plate A—0.0394-in.-thick cold-rolled mild steel
Plate B—0.0394-in.-thick unstabilized 18-8 stainless

TABLE 1 — Cold contact resistance (in microhms) between steel plates and copper-alloy electrodes for varying pressure.

Force lb	Plate A Electrode A	Plate A Electrode B	Plate B Electrode B
440	—	192	316
880	196	128	266
1,320	160	108	196
1,760	118	92	145
2,200	106	84	98

Electrode A—0.196-in.-diameter truncated conical end
Electrode B—2.95-in.-radius round-ended

TABLE 2 — Cold contact resistance (in microhms) between steel plates for varying electrode pressures.

nature and higher conductivity of electrode material.

Electrodes must have high conductivity, and at the same time, retain adequate mechanical strength at elevated temperatures to exert required pressure.

The most suitable material for electrode fabrication is copper alloyed with small quantities of silver, cadmium, chrome or beryllium. Pure copper has insufficient mechanical strength at high temperature.

The electrodes are often heat-treated and may have either rounded or truncated conical ends. The advantages of the former are good contact in spite of any small alignment errors, and softer surface imprints.

Fabrication of rounded electrodes is also easier, and they have better cooling properties. (Electrodes are always water-cooled and great care must be taken to see that cooling ducts are unobstructed.)

Density of welding current passing through the workpieces will be governed by (1) the effective diameters of the electrodes, and (2) curvature radius of their ends, both of which must be varied according to thickness of the plates to be welded.

For a given intensity of current, there will be less rapid and less localized heating (possibly even a lack of fusion) with increased diameter and tip radius of the electrodes.

Table 3 gives recommended electrode dimensions for different plate thicknesses. In practice, electrodes should be periodically checked to see that their dimensions have not been altered.

Electrode tips must be kept free of oxide films or other impurities, since these offer considerable resistance to the passage of electric currents and set up intense local heating.

For the same reason, workpiece surfaces should be scale, grease and rust-free, particularly when welding light alloys whose properties of hardness and conductivity more closely resemble those of the electrodes. Impurities might result in fusion between electrode and workpiece.

Superficial impurities on workpiece surfaces in contact would seem, by increasing resistance and thus generating more heat, to facilitate welding.

In practice, however, the effect might be so great as to prevent passage of the welding current entirely. For this reason, as well as to prevent contamination of the molten pool, all plate surfaces are normally cleaned before welding.

Initial or potential resistances to current passage have been discussed up to this point. In practice, the value of R and certain of its components varies progressively throughout the welding cycle.

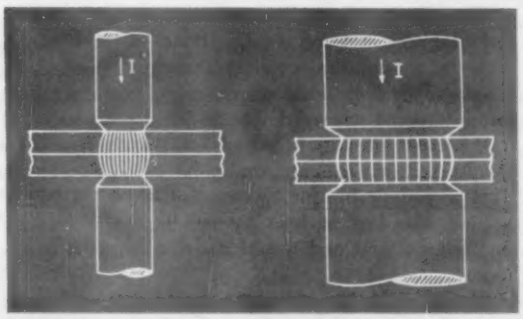
When current is turned on, heat generated at the workpiece junction causes a rapid fall in Rc due to softening of surface irregularities, with a corresponding reduction in total resistance.

However, this effect is quickly overlaid by a significant increase in Rb due to the rising temperature of the workpieces themselves, which automatically lowers their conductivity.

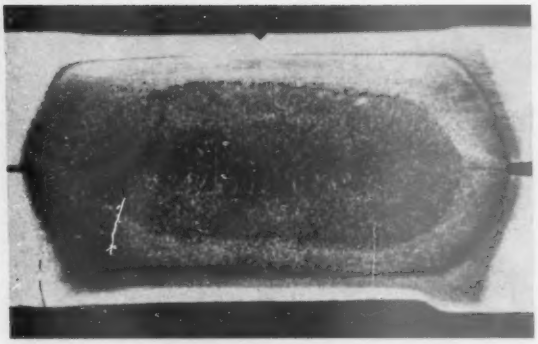
Then, as fusion occurs and spreads, Ra falls to zero and total resistance is again reduced. Thus, progressive total resistance and temperature, plotted against the time in seconds, gives a curve whose actual shape for a given operation will depend on:

(1) thickness of the workpiece,
(2) conductivity of the metal concerned,
(3) welding temperature, and
(4) size of the weld.

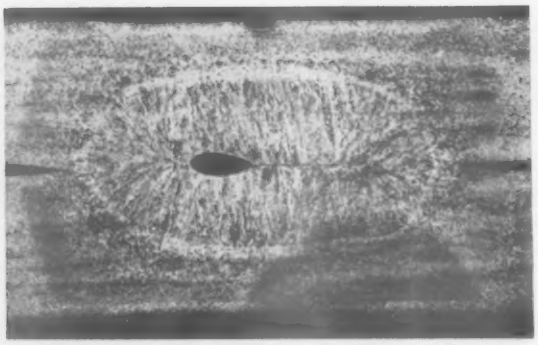
Weld spot diameter will be governed by composition and thickness of the plates to be welded, plus the



FOR a given intensity of current there will be less rapid and less localized heating with increased area of electrode ends.



MACROGRAPHIC sectioned photo of spot weld between plates which have been cleaned before welding.



SIMILAR weld between uncleaned plates shows porosity in the weld zone in this macrograph.

mechanical strength required of the weld. The following figures (in inches) for mild steel plates will serve as a general guide:

PLATE THICKNESS							
0.039	0.078	0.12	0.16	0.196	0.236	0.275	0.315
DIAMETER OF SPOT							
0.196	0.295	0.374	0.472	0.55	0.63	0.17	0.79

To insure a satisfactory weld of the required size, four welding variables must be correctly adjusted: time, current, pressure and electrode diameter. Secondary effects resulting from the basic principles must also be considered.

For example, although resistance of the workpieces themselves is so small that a moderate thickness increase will not significantly lower the value of Rb (and with it the heat generated by current passage), nevertheless, their greater conductivity from increased thickness will result in greater heat dissipation.

The two effects together will materially influence the amount of current required to produce a weld.

Similarly, conductivity of the workpiece metal will govern not only the amount of heat generated by a given current, but also the amount dissipated by conduction. Thus considerably more current is required for welding aluminum than for mild steel, and for mild steel than for stainless steel.

When calculating the amount of heat generated according to $H = RI^2t$, additional energy due to electrode pressure on the workpieces must also be taken into account.

Since for a total given resistance, the heat generated during welding is proportional to I^2t, it is possible to control the amount of material melted by varying I or t (without considering for the moment any additional energy due to welding pressure).

If current intensity is halved, welding time must be quadrupled to generate the same amount of heat. This is undesirable for two reasons.

First, the loss of heat by conduction is directly proportional to t and would therefore also be quadrupled.

Second, a major increase in welding time would cause a greater volume of metal to be raised to high temperature by conduction, with objectionable metallurgical effects in the area surrounding the weld.

Therefore, the value of RI^2 should be kept as high as possible by raising current intensity, maximum intensity being governed by workpiece thickness, composition, required weld spot diameter, welding time and welding pressure.

Although welding pressure contributes to the total energy supplied, its main purpose is, first, to ensure good contact between workpieces, and secondly, to forge them together after the welding current has done its work.

As a rough guide, 30% of the pressure required to rupture or pierce the material being welded can be taken as the required forging pressure.

Welding pressure effects the electrical resistance of the junction between workpieces (though less with steel components). Consequently, there is a direct relationship between welding pressure and the current density required.

Furthermore, if welding pressure is too low or current intensity too high, there is risk of spattering and expulsion of some metal from the molten zone. This may result in poor quality welds and excessive indentation of the workpieces by the electrodes.

The problem can be prevented by varying either pressure or current intensity. In practice, both are varied during the welding cycle by electronic or pneumatic control systems.

Electrode Dimensions

Thickness of plate in inches	End diameter of truncated conical electrode	Radius of curvature of round-ended electrode
0.0394	0.177	1.97
0.0787	0.256	2.95
0.118	0.335	2.95
0.157	0.413	3.93
0.196	0.492	3.93
0.236	0.570	5.9
0.275	0.650	7.9
0.315	0.728	7.9

TABLE 3 — Electrode dimensions recommended for different plate thicknesses.

CHIEF inspector W. G. Singiser demonstrates cart equipped with height adjustment rack which he designed for use with portable X-ray unit. Hose at right feeds low-pressure air for cooling.

Portable X-ray unit is basis of optimum inspection program

THE BASIS OF A TIME-SAVING and safety-promoting program initiated at The Colonial Iron Works Co., Cleveland, three years ago is a portable, high-voltage X-ray unit.

Until June, 1957, the firm (specializing in design and fabrication of steel and corrosion-resistant equipment for the process industries) inspected weld seams with a stationary 140 kv X-ray unit. It was mounted on a skid and moved through the shop by overhead crane.

With the addition of Westinghouse Electric Corp.'s 260 kv unit, Chief Inspector W. G. Singiser began his plan to achieve maximum inspection conditions.

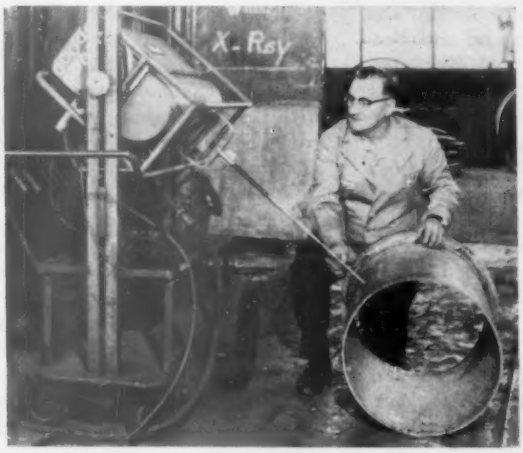
He first designed a lightweight, rubber-tired cart with a vertical structure which permits easy adjustment of the X-ray unit to heights ranging from 2½ to 6 ft.

Although the unit is equipped with a water-cooling system for use in long exposures, Singiser successfully adapted the system to low-pressure air for cooling, since air outlets were conveniently located throughout the plant.

By utilizing the unit's deeper penetration capabilities, he now makes three exposures simultaneously where previously only one was made. Three sheets of X-ray film are taped over the weld seam of an 8-ft-diameter pressure vessel; the X-ray unit is then positioned at the opposite side of the vessel and a four minute exposure at 260 kv, 5 MA is made.

With previous equipment, the inspector had to crawl into the tank, cover the weld seam with X-ray film, and then make the exposure through the ¼-in. metal. The new unit's higher voltage penetrates ½-in. metal, the entire vessel diameter, and the weld.

On routine work alone, such as ½-in.-thick plate with 5/8-in. weld, exposure time is cut in half, according to Singiser. It used to take a six minute exposure for this type of work with the X-ray tube head positioned 30 in. from the film. Now it takes only 3½ minutes.

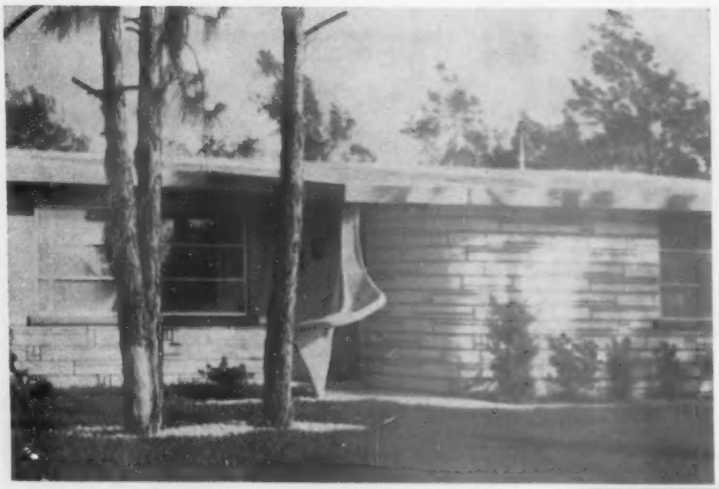


WELD seam on ⅜-in.-thick stainless nozzle is X-rayed with portable unit, two minute exposure at 36-in. film distance, using 200 kv, 5 MA.

The X-ray team performs most of its inspections when the plant is not operating. With the old equipment, radiation exposure badges showed monthly readings ranging from 10 to 90 milliroentgens.

Now the badges show zero, and the credit is given to the portable unit's lead shielding on the X-ray head, along with the firm's usual in-plant safety practices.

The firm has been fabricating custom-built process equipment for 40 years and also makes use of other testing methods, such as dye penetrant, magnetic particle, leak detectors, etc.



WELDED steel rods and sprayed concrete make this house 20% less costly than conventional houses of the same size. Note the welded, concrete-sprayed rainspout near the door and the house's rounded corners.

This is the house that the brothers built

STEEL reinforcing rods are welded to rods stubbed into the poured concrete floor slab.

by Harry J. Miller

Welding and concrete team up to construct Florida's newest home-building entry

MANY PEOPLE from surrounding areas are trekking to Florida—but not necessarily to take advantage of that state's abundance of sun and beaches.

These are home-builders who are interested in a series of houses being built by a Largo contractor. Reason for this interest: a unique process in which an all-welded "birdcage" of skyscraper-like construction enables a house to withstand gales of up to 180 miles an hour.

In addition, use of this welded skeletal framework also reduces building costs more than 20% compared with houses of similar size built by conventional methods.

Called Uni-Con by its developers, Fred and Theron Federspiel, this fireproofing, windproofing process is currently saving more than $2,000 on an $11,000 house. Hence, many refinements can be added to the house, eclipsing the offerings of other area contractors.

For example, large savings can be realized since round and Vee-type corners can be easily fashioned without cutting rafters or getting involved in complex carpentry and masonry applications.

A house starts with steel rods which reinforce the poured concrete foundation and floor slab. Under these rods are welded, 3/8-in. reinforcing rods stubbed so they extend from 8 to 12 in. above the floor slab.

To these stubs are welded the steel rods which form the walls and roof. In its initial stage, this house of welded rods looks like a huge birdcage (see photo p. 46). Rods are shaped and welded in place to form roof ridges, partitions and wall corners.

Wood blocks, serving as spacers, are placed against the rods. On the interior sides, polystyrene insulation is wired to the blocks.

A one-inch thick layer of concrete is then sprayed over the entire "cage" by means of pneumatic equipment. The concrete develops a flint-like hardness, double that of poured concrete. Three more coats of concrete are then applied.

Other substantial savings can be realized since the entire framework can be sprayed in four hours by unskilled labor. And since wood is used only on doors, expensive carpentry work is eliminated. In addition, little painting is required

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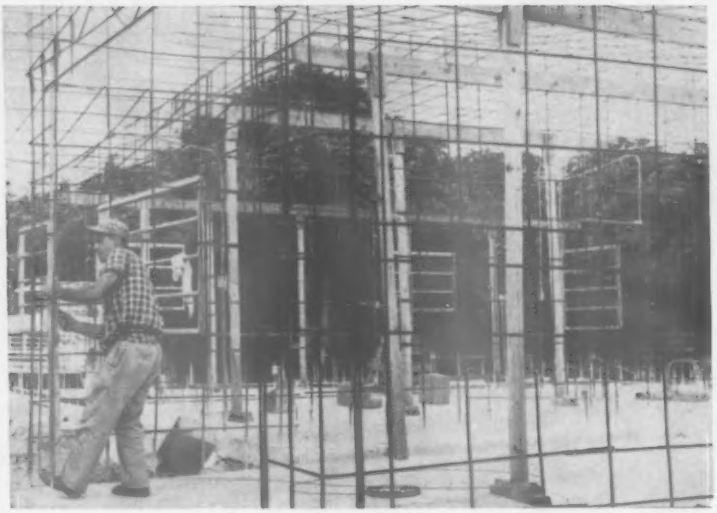


WOOD supports temporarily shore up the steel rods giving the house framework a birdcage effect. Worker easily rounds corners by bending the steel rods.

and the plaster is also sprayed, using unskilled labor.

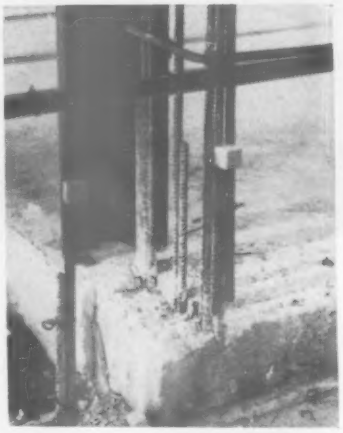
The Federspiels have a patent pending on the process, which will soon be franchised across the entire country.

An interesting aspect of the welded construction is the roof, which begins with a network of 3/8-in. rod arranged in about 6 in. by 9 in. grids to which the insulation is wired. Sheets of corrugated steel, supported by temporary wood Tee-frames, shore up the steel while the concrete is sprayed.

The concrete settles into the spaces behind the rods and within hours the roof is self-supporting, so the corrugated steel is moved to the next job.

The completed house has a conventional external appearance, belying its resistance to termites, wind and fire. This use of welded steel framework and sprayed concrete effectively eliminates the old-fashioned and uninsulated concrete blocks which usually resulted in costly maintenance and repair because of the house's settling.

These houses are designed by structural engineers and the possible economies to be realized from this welded steel and sprayed concrete process are attracting contractors and builders to Largo to learn the principles involved.



PRIOR to welding operation, the steel reinforcing rods are wired together.

WORKER sprays concrete on welded steel rods and polystyrene insulation to make house a strong, economical unit.

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ELEVATORS on world's largest ship are Mig welded aluminum. In this model of the ship three are on the starboard side with planes parked on them. Fourth is on port side, aft.

Welded aluminum elevators serve on first nuclear aircraft carrier

THE FIRST NUCLEAR-POWERED aircraft carrier and largest ship in the world, *USS Enterprise*, is being rushed to completion in the bustling yards of Newport News Shipbuilding and Dry Dock Co.

Built to a colossal scale, the 1,100-ft warship will be armed with the hottest, most modern fighting aircraft ever designed for carrier service.

To handle these advanced jets, all plane-carrying elevators spotted along the giant's 252-ft-wide flight deck are fabricated of aluminum extrusions and plate supplied by Aluminum Co. of America.

The elevators, three to starboard and one to port, are of all-welded construction in high-strength aluminum alloy. Each is 52-ft wide, 85-ft long, and weighs 105 tons — a 30-ton saving over high-tensile steel.

Lighter, less bulky machinery than normally could be used will supply operating power to raise and lower the structures, as planes are shuttled between hangar and flight decks.

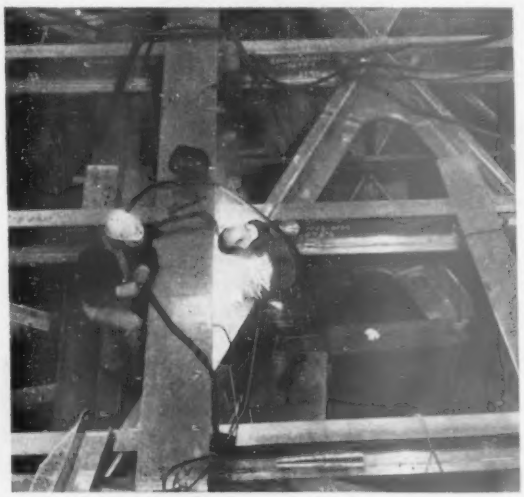
Each elevator was built around three load-carrying structural systems, with each system distinguished by the size of its main members, aluminum I-beams.

All I-beams used were fabricated of aluminum plate ranging up to 2-in. thick, using a semiautomatic Mig welding set-up. Top surface of each elevator (a grating structure) was fabricated by welding short lengths of Tee-shaped extrusions.

These extrusions, spaced 1½-in. apart, were welded crosswise between 30-ft-long I-beams, 12-in. deep (distance between top and bottom flange of the "I").

This system rests on a secondary structure built of 16-in.-deep I-beams. The entire weight of each elevator is carried by huge 10-ft-deep beams which form the main supporting structural system.

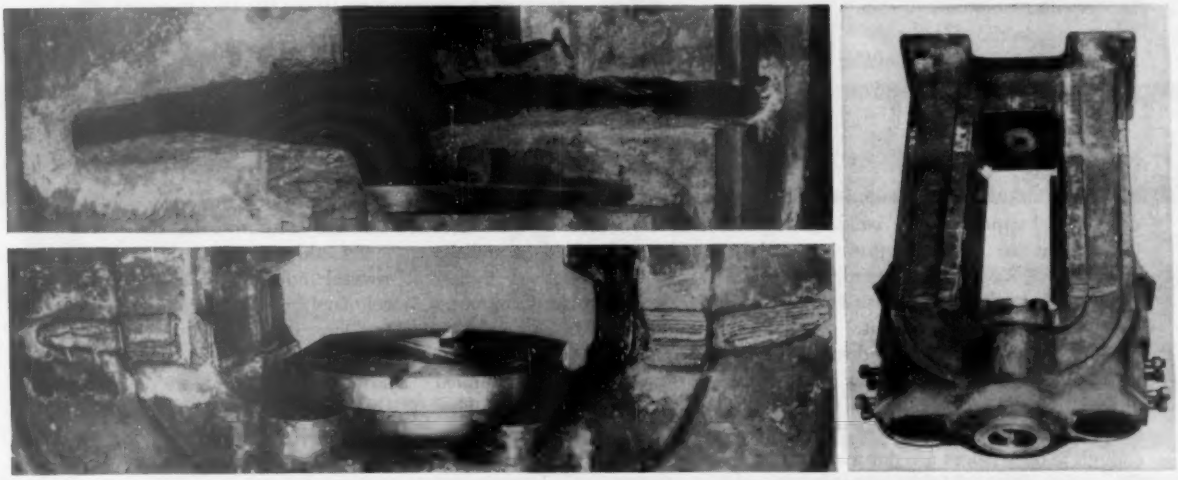
The carrier's eight nuclear reactors are expected to operate five years on the first charge of fuel. With this danger of fuel shortage removed, the 86,000-ton mobile air base can run at sustained speeds of more than 30 knots for practically unlimited periods. Launching and christening is scheduled for this month.



LEFT — Aluminum I-beams as large as 10-ft deep were Mig welded as part of elevator structure. RIGHT — I-beams are welded together in final assembly. Approximately 10 tons of welding wire were used.

201 WAYS TO BETTER WELDS: HERE'S ONE...

Huge swaging press went out of action when deep cracks opened in its 25-ton cast steel frame. Weld repair posed problems: heat danger to base metal; high strength demands.



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Scholarship awarded

Midwest firm calls for industry participation in welding education

by Irv Silver
York Engineering Co.
Subsidiary of Chicago Welding Sales Co.

AWARD for scholarship in welding engineering at Ohio State University is presented to Joseph Nunnikhoven by Irv Silver, as College of Engineering dean Harold A. Bolz (l.) and Welding Engineering Dept. chairman Roy B. McCauley, Jr., wait to congratulate the winner. In accompanying story, Silver tells why his firms, Chicago Welding Sales Co. and York Engineering Co., donated the scholarship. (For news of another scholarship, see page 23.)

WELDING ORIENTED PERSONNEL don't just happen. If the welding industry is to continue growing and not be slowly smothered, it must help provide adequately trained personnel to serve it.

Major portions of U. S. industry still have not given welding its proper recognition. Many jobs are not welded because of a fear that enough good weldors are not available. Yet many welding trade schools are closing every day.

Many groups do not use welding because adequate inspection and supervision are not available. Many products are not designed for welding because engineers are afraid to enter unfamiliar areas.

Yet the only university in the country offering an approved welding engineering curriculum can barely justify that department's existence because of its lack of students.

Most of us in the welding industry do not realize the deplorable state of welding education. Let's examine some facts:

(1) The welding industry reached a sales total of one billion dollars last year.

(2) There are approximately 100 formally-educated welding engineers in the U. S. having college degrees in welding engineering.

(3) Ohio State University is the only accredited school in the U. S. offering a bachelor's degree in welding engineering.

(4) Russia graduates approximately 850 such engineers yearly.

American industry has done a marvelous job of welding development with the brain power available. But how much faster and how much more could have been done if more intentional, rather than accidental, welding engineers had been available.

The "accidental" welding engineers are the chemical, mechanical and metallurgical engineers who, finding themselves in welding, have done a creditable job. But surely welding's future lies in intentional and deliberate development of technical personnel.

The basic cause of the existing condition is a failure to promote welding as a career. We have taken much from this industry, but have given little toward its continuity.

A number of high school vocational guidance directors were surprised to learn there is a need for welding engineers and that a degree is available. High school seniors, desiring to enter engineering, on the whole were equally ignorant of this need.

The demand for Ohio State welding graduates by industry exceeds that for graduates of other engineering schools by 500%, and their income exceeds that of other engineers with equivalent time experience by 20%.

In the past year, a beginning for more aggressive publicity in welding education has been initiated. The National Welding Supply Association earmarked $10,000 for a film, "The Story of Welding," to be made by Ohio State.

The film will be circulated to Career Day programs, high school seniors, vocational guidance meetings, and any organizations that can use it to advantage.

As added impetus to publicity, several additional (to our own) scholarships have been awarded to Ohio State by various firms in the welding industry. But there is still much to be done.

Industry can offer educators experience in welding fabrication, current industrial needs and trends during the summer. An educational staff or chair could be sponsored by a group of industries, which would underwrite the expenses.

Loans can be made of the latest equipment to upgrade teaching excellence and keep university labs abreast of new developments. Direct contributions could be made to defray cost of replacement teachers and traveling expenses so educators could attend technical programs. Research could be financed through fellowships for promising graduate students.

As to individual contributions:

1—Encourage any high school boys inclined toward engineering to investigate welding as a career.

2—When the proposed film is ready for circulation, encourage your area high school, clubs, organizations, etc. to use it. (It will be available from Ohio State University's Welding Engineering Dept.)

With our scholarship contribution to welding engineering education, we hope to help overcome, in a small way, some of the existing educational problems and to encourage others to do the same to the best of their ability.

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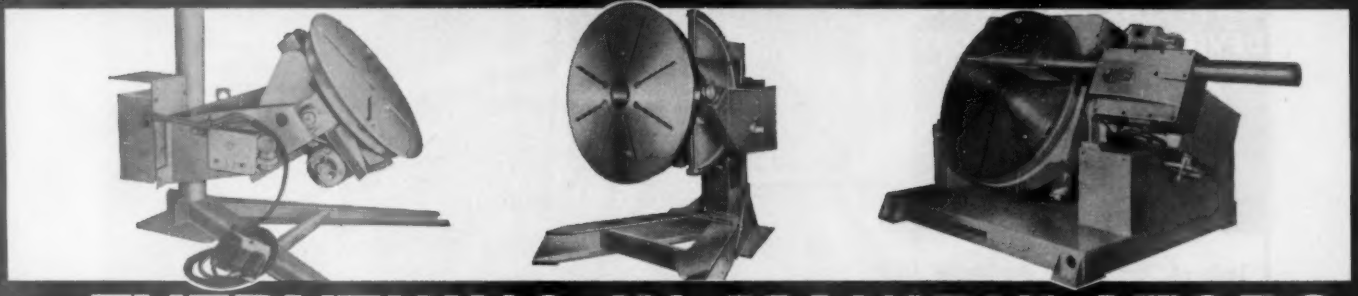

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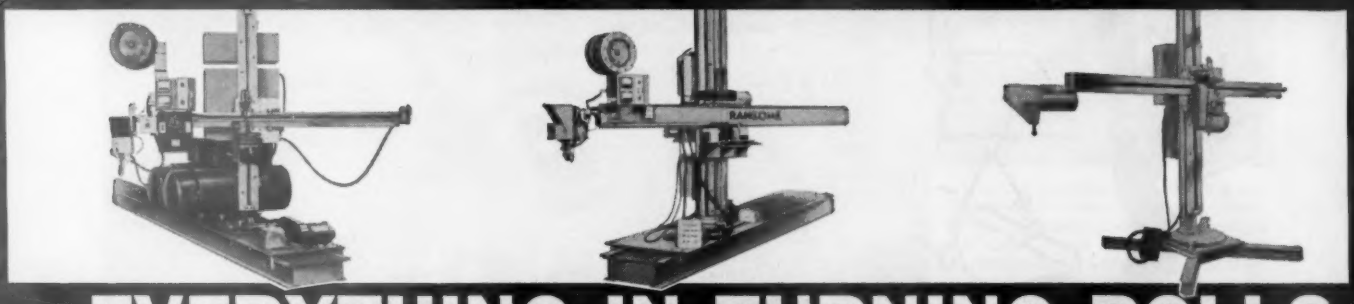

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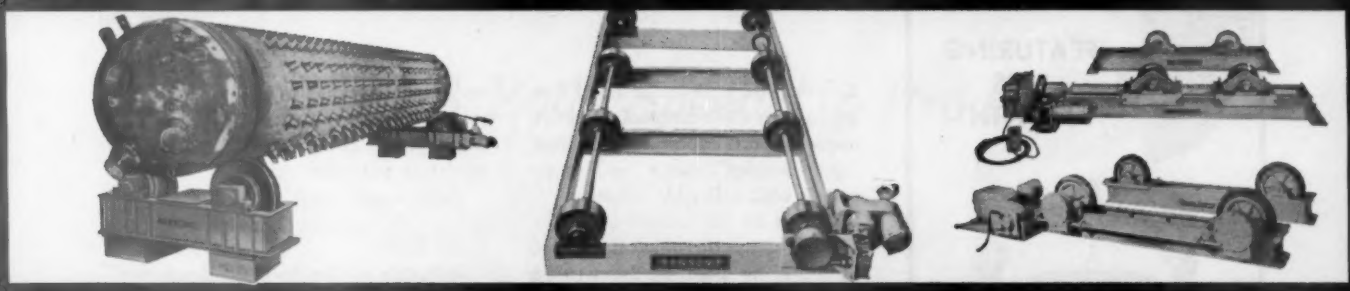

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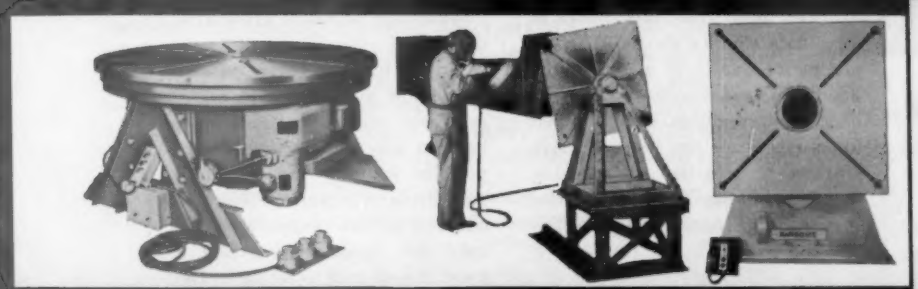

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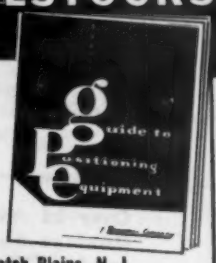

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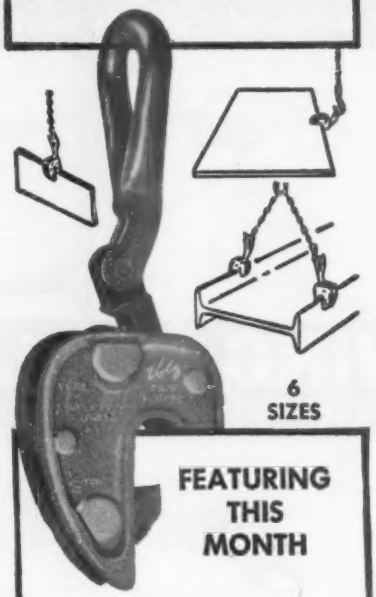

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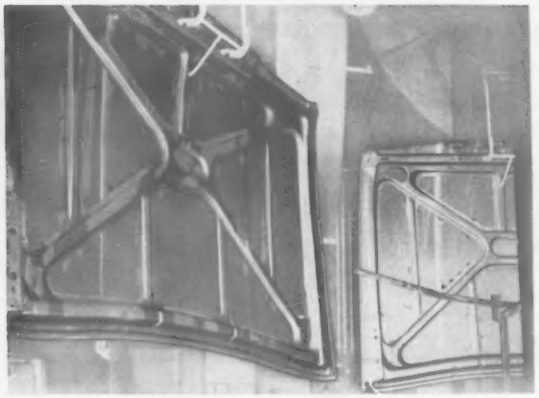
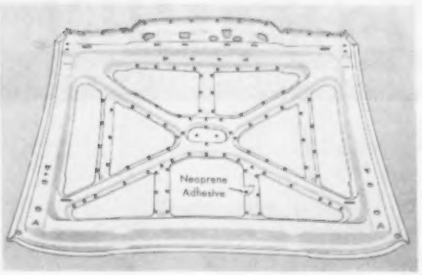


HOOD assemblies leaving phosphate treatment.

ADHESIVE is automatically extruded onto 45 spots between hood's outer and inner panels.



Adhesive "spot welds" hood assembly

To PREVENT high-speed hood flutter on their 1960 automobiles, engineers at Ford Motor Co., Detroit, "spot welded" inner and outer panels with a flexible adhesive.

Choice of the adhesive — neoprene, a synthetic rubber developed by E. I. du Pont de Nemours & Co. — came only after extensive chemical, physical and thermal stability tests.

The adhesive was automatically extruded onto the outer panel at 45 points simultaneously. The inner panel was then mated to the hood and hem welded. While the hood sub-assemblies were shipped to assembly plants, the adhesive air-dried to a partial cure, making it safe from damage by powerful sprays used to clean and phosphatize the panels.

In the primer and enamel ovens, the adhesive achieves its complete cure. At this point it has developed its full adhesion value (approximately 80 psi), making the two hood panels a single unit for all practical purposes.

Advantages cited by Ford for using the neoprene technique include these:

—Weight of the hood is greatly reduced.

—Automated application is much faster than conventional joining methods.

—Flexible adhesive gives a well dampened assembly.

Credit for the operation's success is due in large measure to the neoprene adhesive's ability to adhere to oily metal; to remain in position without slumping during paint-bake exposures; to remain adhered at low temperatures despite the shock of slamming the hood closed; and to retain its flexibility while experiencing the natural 15 cps vibration of the hood throughout the car's life.

HAYNES STELLITE alloy No. 1 is deposited on under-surface of diesel engine rocker levers and upper surface of cross heads with this HAYNES straight-line hard-facing machine. Sound, uniform deposits are easily machined. Engines are quieter, more efficient.

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ANY IDEA which can cut welding time from 90 to 45 minutes on missile beams for the Army is darned important! That's exactly what happened in a New Jersey plant.

A LINCOLN Field Engineer was walking through the plant with the Welding Foreman and Plant Manager. Naturally he was interested in watching the welding operation on missile beams. A thought crossed his mind. He asked if he could demonstrate LINCOLN Jetweld electrodes on the beams. He rolled up his sleeves; took some Jetweld from the trunk of his car, and cut the welding time from 90 to 45 minutes. The weldors on the job did the same.

That afternoon the Field Engineer finished his plant tour and spotted some applications for Fleetweld 37 electrodes for welding sheet metal on trailer bodies. Again welding time was cut almost in half, cleaning time reduced and overall costs slashed to the bone.

Quite a day's work for one Field Engineer . . . but putting PROFIT into welding operations is part of each LINCOLN man's job. You can count on him to show you . . . not tell you how to cut costs and make more money.

That's why we say it's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a "plus" at no charge.

Call your LINCOLN Field Engineer today.

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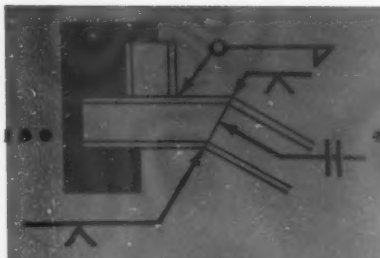


the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Plasma heat and its applications

Question:

Having recently become a WELDING ENGINEER *subscriber, I wondered if you can tell me what plasma heat is and how it applies to welding.*

Answer:

Plasma heat is the result of electrically heating a gas to such high temperatures that its molecules become ionized atoms containing high energy. Physicists consider plasma a fourth state of matter, neither gas, liquid nor solid.

Used in a torch, the plasma-forming gas (nitrogen, hydrogen, etc.) tends to cool the chamber-enclosed arc, producing a "thermal pinch." Thus, arc current is restricted and resistance increases.

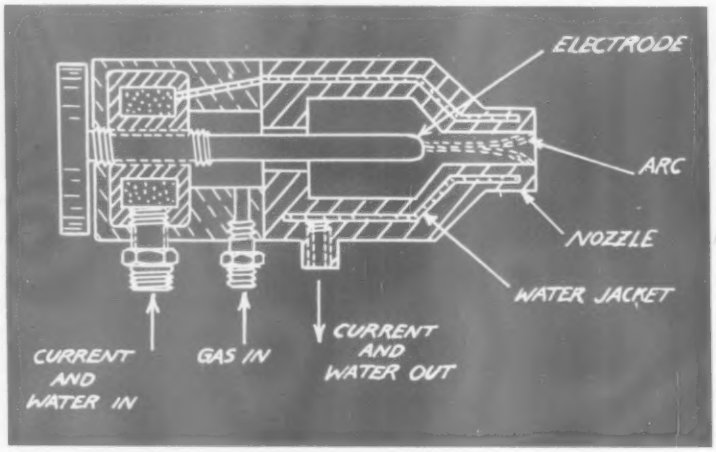
The pressure and forces developed then cause ejection of the plasma in a stream or plasma jet at very high (up to 30,000 F) temperatures and speeds. To withstand these high temperatures, a water-cooled copper-alloy nozzle is used.

The drawing on this page shows the plasma-arc torch developed by Thermal Dynamics Corp. Electrical power for this unit is obtained from d-c welding generators, either engine-driven or rectifier types. Two 600-amp units power a 50-kw plasma-arc torch, and voltage requirements are determined by the gas being used.

Plasma heat can do all those things that could not be done with a chemical flame lacking sufficent heat. The peak temperature of any chemical flame is limited by dissociation reaction of the fuels.

Dissociation absorbs energy which might otherwise be used to raise the temperature. When gas is heated by an arc, however, heat intensity is limited only by the amount of heat added to that gas.

Plasma-arc equipment is now available from four manufacturers: Arco Manufacturing Corp., New York City; G. M. Giannini & Co., Inc., Pasadena, Calif.; Metallizing Engineering Co., Westbury, L. I., N. Y.; and Thermal Dynamics Corp., Lebanon, N. H.



The greatest advances in plasma-arc should occur in the welding industry since its high temperatures can make joining of hard-to-weld metals much easier. However, other metalworking processes have also adopted the plasma-arc.

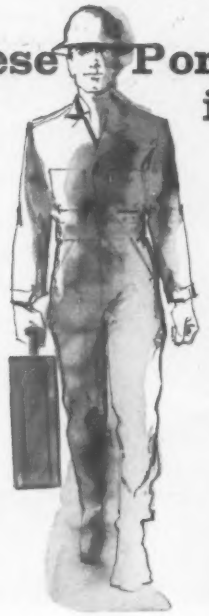
A metal-cutting torch, similar to a plasma-arc torch, is now being used for high-speed cutting of nonferrous metals and alloy steels. (Technically, this is a transferred-arc torch. In the plasma-arc torch, the arc is wholly contained and termed non-transferred.)

A form of metallizing also has been developed. Powder is contained within the plasma flame and projected at high velocity against a part being coated. The high temperature permits continuous spraying of extremely refractory materials such as tungsten and high-melting-point oxides and carbides.

Still another application is gouging. The steel being treated is brought to melting temperature on contact with the plasma and the high velocity of the jet stream removes the molten materials.

Plasma flame is capable of stream velocities and temperatures covering a wide range of values. Jet velocities of well over 20,000 ft per second are possible and are used when maximum heat transfer rates are required.

these Portable Units bring magnetic particle inspection wherever needed . . . *in shop, in field*



Between them, this brace of magnetic particle units can solve many an inspection problem—maybe even one that's troubling you right now. Each, within its compass, has a capability approaching that of "big" machines. Each is light enough for one man to carry to the job. Each is self-contained: works efficiently off any 110 volt AC line. PORTAFLUX shines at some kinds of inspection jobs, FERROFLUX excels at others . . . depends on circumstances.

Talk it over with your local Picker man. He'll be glad to examine your situation, offer expert counsel and recommendations. (That holds for many other non-destructive inspection methods, too: he has a lot of them in his bag. The listing below suggests some of the ways in which Picker may serve you).

portaflux induces a magnetic field in the inspected object by passing a 500 ampere AC current through it. Provides *longitudinal* or *circular* magnetization with coil or prod technics to handle a wide variety of parts. The whole works—generator, control, prods and cable, pack up in a rugged aluminum case: total weight, ready to go, is only 60 lbs. Great for shop, aircraft, automotive maintenance inspection. Inspection of tools and dies, for fatigue cracks, etc. Inspection of turbine parts, small shafts, etc. in power plants. All this for only $500.00 complete (*price slightly higher in West*).

ferroflux is a powerful electromagnet which produces a magnetic flux in the area of the inspected part straddled by the magnetic poles. (Optionally available is a Variac voltage regulator for reducing or increasing flux.) Specially good for detecting subsurface defects because magnetic flux permeates object. No possibility of arc-damaging surface because no current passes through object. An excellent unit for inspecting welds in pipelines and pressure vessels and for detecting heat-treating and grinding cracks. Weight 30 lbs. All this for only $415.00. Variac voltage regulator $97.50 extra (*price slightly higher in West*).

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gamma radiography	**PICKER** *Pipeliner*—30 curies, Ir^{192}, *Cyclops*—1500 curies; Co^{60} **TECH/OPS** Iridium^{192} units from 10 to 100 curies; Cobalt^{60} 3 to 100 curies: also Thulium^{170}, Cesium^{137}
fluoroscopy	**PICKER** Image Intensifier and associated equipment
magnetic particle	**PICKER** *Ferroscope* *Ferroflux* *Portaflux* **PIXmag** Ferropowders and pastes
dye penetrant	**PIXchek** Penetrants, Cleaners, Developers, and accessories

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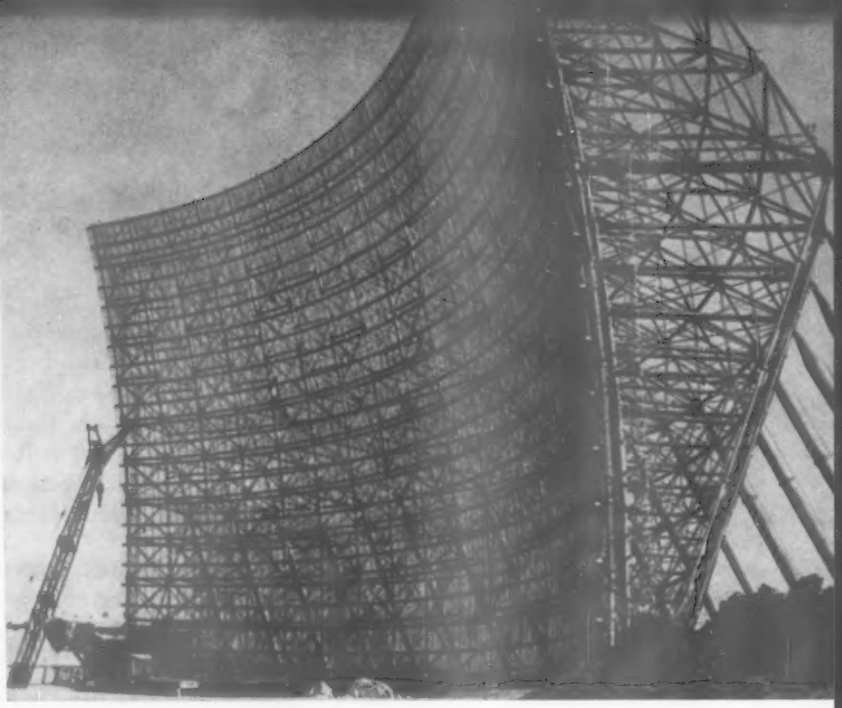
by W. R. Schneider



UNDER construction at an arctic base is 17-stay-high, Torus-shaped antenna reflector.

Quality control is a must when welding radar antennas

ASSEMBLY OF MORE THAN one million parts, weighing almost 10½ million lb, and involving 168,000 ft of welding (including more than 3.5 million spot welds) presents more than the usual number of problems.

Add to this the requirement that the unit be designed for low temperature service and erected in an area where there is little or no equipment for field welding, and the difficulties loom larger.

The problems, however, are being faced – and solved – by D. S. Kennedy & Co., Chasset, Mass., currently working with electronic industries to design and fabricate radar antennas for arctic bases.

Welded manufacture of structural radar equipment for this kind of service requires close coordination and control of materials, filler metals, design, manufacturing processes, testing and quality control. And since field equipment is usually at a minimum, every piece of steel and hardware must be completely prefabricated in the shop.

In the past several years, two grades of steel have been used for the antenna's structural members: ASTM 203 Grade D (3½% nickel) and 203 Grade A modified (2¼% nickel). These steels can be welded with manual metal-arc or automatic and semiautomatic submerged-arc welding.

However, the company felt submerged-arc would not lend itself to a practical application for several reasons; semiautomatics would have to be used, and since downhand welding was required, proper positioning of parts made it difficult to use in all areas.

Also the proximity of other parts on many of the components to be welded was such that they did not lend themselves to the size and shape of semiautomatic equipment.

On the job, there are many applications with tubular and pipe weldments, either pipe-to-pipe or pipe-to-flange with circumferential welds. Because of jigging and fixturing, much of the welding is out-of-position and either downhand or vertical — and submerged-arc is limited to the former.

However, in spite of these limitations, impact tests were conducted on submerged-arc welded nickel steel. The testing temperatures were –25 F, –50 F and –75 F. All tests were made on 1-in.-thick plate. As a result of the testing, all welding of the two grades of nickel steel was done with low-hydrogen E8016 CL electrodes.

These electrodes, however, require proper storage to prevent any moisture pickup, which can lead to underbead cracking and hydrogen embrittlement of the weld.

Tests previously conducted on E7018 MO electrodes showed this electrode to have a greater affinity for water because of its powdered iron coating. In the tests, some electrodes were taken from a sealed can; others were left at room temperature for a time; and still others were baked at different bake cycles.

As a result of these tests, the following observations were made:

(1) A baking temperature in excess of 450 F is required to insure reduction of moisture content to less than 0.08%.

(2) The capacity of the coating to re-absorb moisture is inhibited by high baking temperatures, *i.e.*, the higher the temperature, the less moisture re-absorbed.

(3) Electrode moisture content as removed from the sealed container is 0.14%, already dangerously high, and in this condition, coating absorbs water very rapidly.

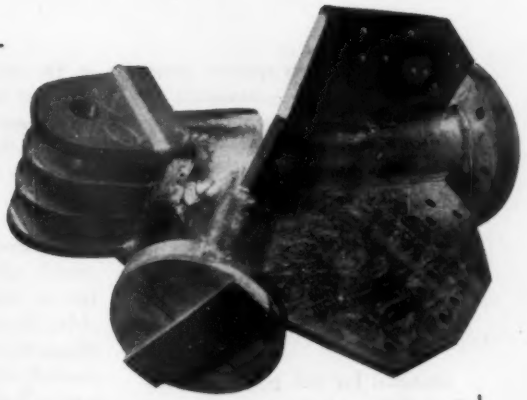
Thus, storage of low-hydrogen electrodes is an important consideration if quality control is to be maintained.

Further tests on electrode performance were made to determine welding ability under various conditions, *viz.*, whether weld deposition was better on a-c or d-c power, and whether the electrode would offer any difficulties in vertical welding.

The test was made on an ordinary "Tee" fillet with one pass in and two over. It consisted of one for downhand and one for vertical with a-c and then an exact repeat with d-c, reverse polarity.

The results indicated that the

. . . . and how they grew



IN ALL FABRICATION of these giant antennas, six different members are used: columns, joints, back struts, foot plates, stringers and finally panels.

The columns are pipe lengths from 10 to 16-ft long with a welded flange on both ends. The flange is a piece of plate with its OD burned to shape and its ID bored for proper fit-up conditions.

In addition, several columns have flat plates, ultimately serving as gusset connections, welded to the pipe's side.

Since fabrication is by manual metal arc and two weldors work on one column at the same time, all columns are fabricated on rotary turning rolls.

Turning rolls are foot-operated and controlled by the weldor who joins the flange to the outside of the pipe. The other weldor joins the inside diameter of the flange to the pipe end, synchronizing his work with the first man; in this way, one pipe rotation completes the joint weldment. Fillet weld sizes vary between 3/16 and 3/8 in. Welding is done with 3/16-in.-diameter electrodes.

Since welding is confined to certain column areas, a propane compressed air torch is used for localized preheating with a minimum of 250 F. Preheating temperature is checked periodically.

Joint welding follows almost the same sequence as the columns. However, they are smaller and offer many more flange and plate type connections.

Back struts or trusses are tubular with three-sided triangular design. All pipe connections are pipe-to-pipe or pipe-to-plate at various angles with no beveling done on these applications.

They are strictly fillet welds made with either 5/32 or 3/16-in.-diameter electrodes. This particular unit is set up in a jig which is adaptable so it can be rotated into position.

Foot plates are heavier type weldments with a bottom plate and clevis plates welded to it. Because of this design, the clevis in some cases goes through the bottom plates, while in others, it is butted to it and joined with a fillet weld.

Stringers of mild steel are tack welded over a rather long area. These assemblies are then welded with E6014 electrodes in 5/32 or 3/16-in.-diameters depending on the fillet size required.

Panels are not prime structural-supporting elements, but support the antenna's screen surface. Panel frames are tubing material, 2-in. OD, 0.049-in. wall thickness. Screening is carbon steel.

The four-sided panel frame has four-corners coming to a fish-mouth connection with an angle and two supporting tubes through the middle.

Since the panels are electro-galvanized and painted, the welding process could not present problems in cleaning or slag removal.

However, the frame tubing did present difficulties, particularly on the fish-mouth connections, due to the light wall thickness; it was impossible to weld even with a 0.035 diameter wire.

An inert-gas process with a reactor in the welding circuit allowed the weldor to work on much lighter gage materials. The reactor, however, changed the process from a spray type transfer to a globular type, which caused a large-crown bead.

Weld deposit had to be reasonably flush with the frame sides since the screen was resistance welded to the frame on one side and the high crown bead prevented the screen from lying flush.

The problem was solved by Tig welding with a filler rod and generally limiting fish-mouth welds to 1-in. tack welds on both sides of the frame.

Within the panel are 3/16-in.-thick clips which must be welded to the frame side. In this application, as a subassembly operation, Mig welding with a 0.035-in.-diameter wire was used. The weldor could concentrate the heat into the heavier member and thus eliminate burn-through.

Likewise, a 1/8-in.-thick angle brace in the frame center was welded to the frame with the same process. Again, wire was 0.035-in. copper flash. Gas flow was about 30 cu ft per hour with d-c reverse polarity at approximately 150-175 amp.

Screen to frame welding was done with two 50 kva press type resistance welders; one mounted permanently on the floor and the other mounted on an air-operated sliding base with adjustments for welding around the panel perimeter.

A special electrode, conforming to the half-round frame tube, is used on the bottom. The top electrode is about 6-in.-long straight flat copper which lowers and rests against the screen surface. Welding condition varies between 2 and 8 cycles of weld time with 700 lb of electrode pressure.

latter gives far less spatter, better arc control and a minimum of porosity, which generally applies to all low-hydrogen electrodes.

After determining the material, the process and the electrode, impact tests were made to verify the minimum requirements at –65 F. At the same time, impact tests were compared between as-welded and stress relieved samples.

Material for this test was 1-in.-thick 2¼% nickel steel using an E8016 CL electrode. Joint preparation was a single "Vee" with the bevel on one side so the faces between the fusion zone and the heat-affected zone and base metal would all be generally perpendicular to the plate surface.

Since the notch length of an impact specimen is supposed to be perpendicular to the plate surface, this joint geometry insures that all metal under the notch will be of the same structure. That is, if a specimen is notched at the interface of the heat-affected zone and the fusion zone, the fracture path will be throughout that region.

However, with the standard double "Vee" preparation, the crack will leave that region and cross through the heat-affected zone and enter the base metal giving an average value.

After half the specimens were stress relieved, they were all etched prior to finish grinding so that notches would be accurately placed in the weld center, in the heat-affected zone and at the interface between the fusion and heat-affected zones. Specimens were then given a Charpy "V" notch test at —65 F.

NICKEL steel pipes in welding tower show size of problem encountered in antenna fabrication.

The stress relieving operation adversely affected the impact properties of the weld metal, but favorably affected those of the heat-affected zone while having no substantial effect on those of the interface between the two.

Equally important when welding on nickel steels is the proficiency of the weldor. Some additional training in technique is usually necessary when E8016 CL electrodes are used, since a close arc length is required and certain limitations are made on the amount of weave and whipping that can be used. And when vertical welding, proper electrode angle is needed to prevent fingernailing.

However, before any fabrication is begun, Kennedy engineers prepare a Welding Procedure Specification which covers each major area of the welding job, insuring uniform results through understanding of the correct procedures.

The specification also serves as a guide for the welding foreman and for the quality control department. For the latter, it is the basis for acceptance or rejection of a weldment, and provides a description of all areas to be maintained and controlled.

The first section of the specification gives a description of the base material to be used and details its qualification requirements. A second section is devoted to the electrodes required, as well as qualifications applying to both weldor and welding process.

Also detailed is equipment to be used and selection of either a-c or d-c power sources, including the operation of this equipment and any precautions concerning safety requirements. Preheating requirements, if any, are also defined, and maximum and minimum temperatures are listed.

Other sections of the specification are concerned with:

(a) Joint design, preparation and assembly.

(b) Tack welding and cleaning preparations, including requirements for sandblasting or wire-brushing.

(c) Weld deposition in reference to both fillet and butt joints, including the amount of deposition per pass, sequence of deposition and number of passes.

(d) Interpass cleaning, requirements of weld reinforcement for both butt and fillet joints, and requirements of final cleaning.

The major section of the specification, of course, is devoted to operation. One important segment is a breakdown per fillet size for the assembly to be welded, including the number of passes per fillet and any inspection requirements (magnetic particle, gamma or X-ray).

From a practical standpoint and as a production aid, magnetic particle testing is used. In general, all root beads are checked, as are alternate layers or a certain point in weld metal deposition, and all final weld beads.

When surface cracks are present, further examination by magnetic particle is conducted to determine their depth and any other subsurface defects.

Magnetic particle equipment used operates in a range of 1,000 to 1,200 amp d-c and is considered reliable for a 3/16-in. thickness. Therefore, when fabrication is started and root bead and alternate layers of weld metal are examined, there is assurance that with the final bead the structure will be 100% sound.

All tack welds are inspected prior to finish welding and any that show defects are removed and rewelded. As mentioned above, root passes on all weldments are magnetic particle inspected, but where the majority are single or three-pass fillet welds, only the root and final bead are checked.

The final bead is inspected both before and after stress relieving since in many cases post-heat treatment can cause shrinkage cracks.

In any welding fabrication, day-to-day problems do develop. But by analyzing the material and filler metal, by selecting a proper welding process, by preplanning tooling and sequence operations, and by maintaining proper quality control, fabrication problems can be kept to a minimum.

BRIDGEPORT WELDING ROD

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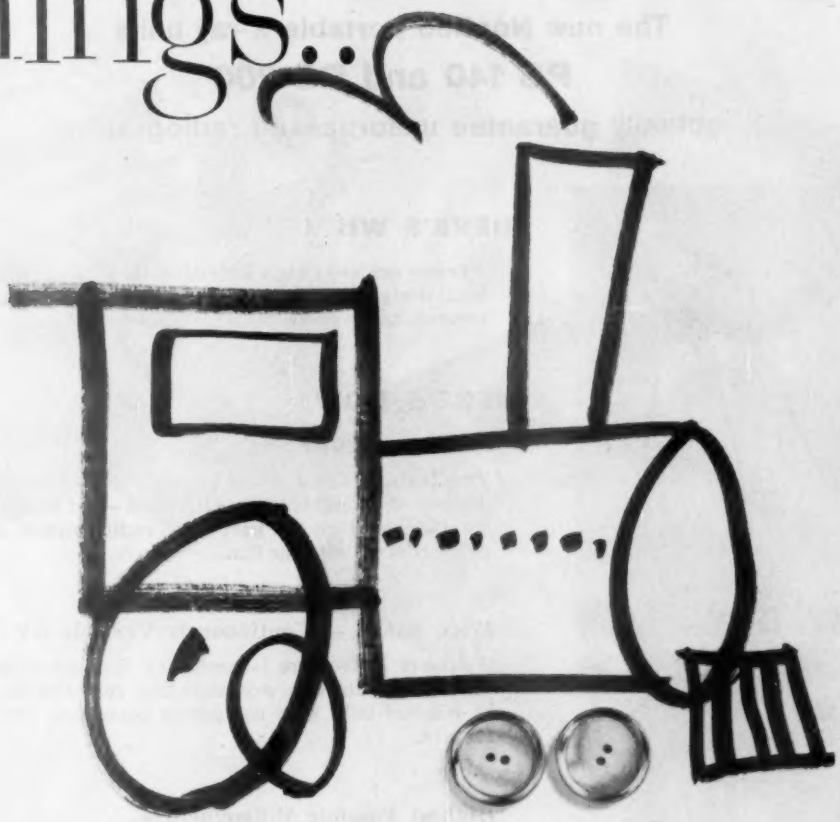

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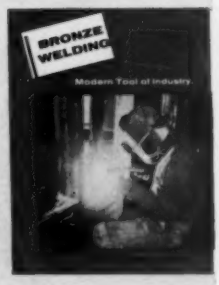

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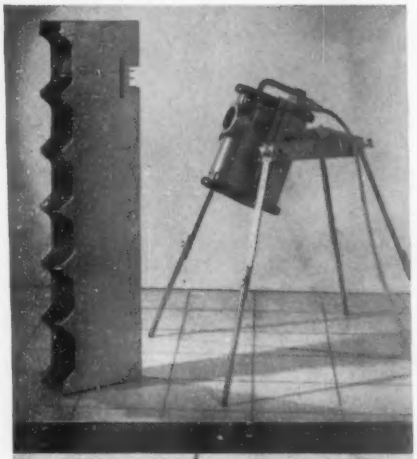

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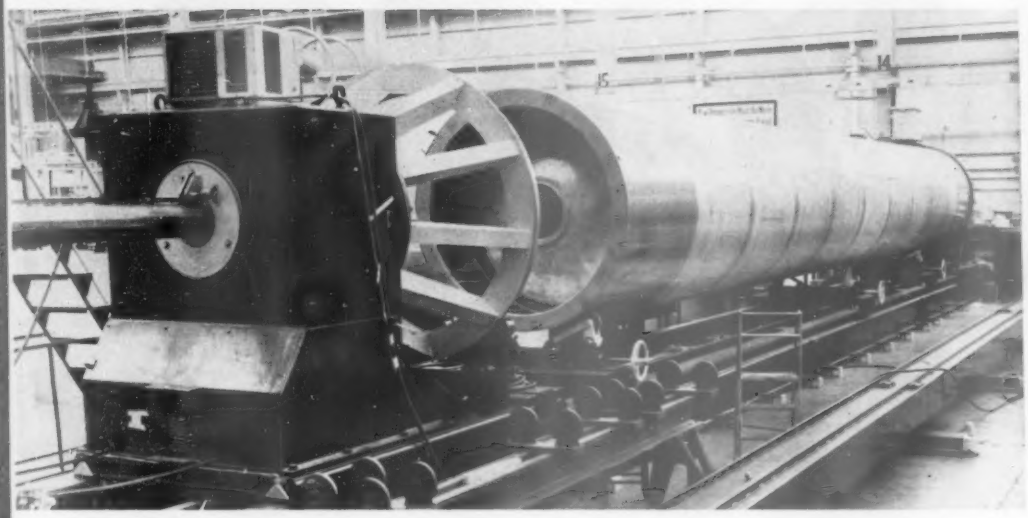
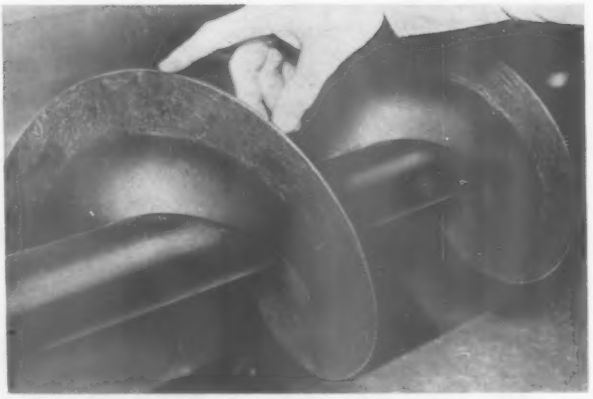


SKIN of 70-in.-diameter tank for project Saturn is welded alloy 5456 aluminum sheet. Eight such tanks will carry fuel and liquid oxygen for the Saturn super-booster; Finished booster will have a 1.5 million lb thrust rating. Aluminum is supplied by Aluminum Co. of America, Pittsburgh.

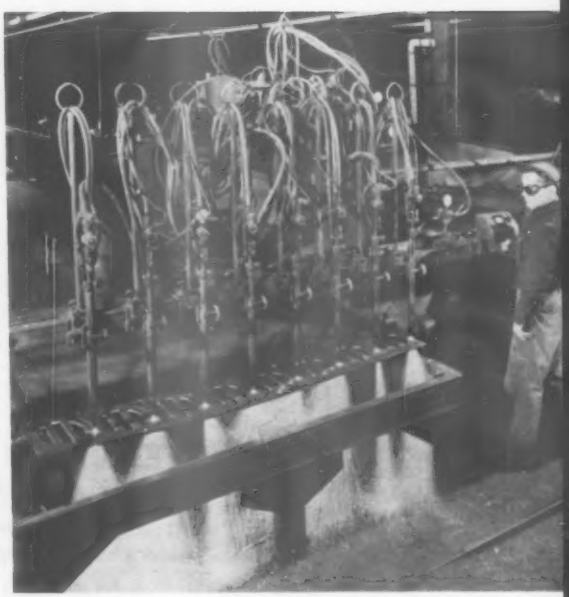
On the job...

THIN, even application of fused paste overlay increased life of screw flight face greatly. Affected surface becomes hardfaced as a result of alloying of base metal with paste, made by Wall Colmonoy Corp., Detroit.



RIGHT — MULTI-TORCH cutting operation in progress provides eight identical patterns on steel sheet. Equipment is that of Harris Calorific Co., Cleveland.

OPERATOR makes fillet weld on portion of multi-use duo-pactor, employed in rolling road filler material. Michiana Products Corp., Michigan City, Ind., fabricators, chose submerged arc process of Linde Co., New York City, for the work.



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30 YEARS AGO

(Taken from **Welding Engineer** of September, 1930)

Ray P. Tarbell, former Cleveland district sales manager for The Lincoln Electric Co., has joined the firm of Robert E. Kinkead, Inc., consulting engineers.

—30 Years Ago—

J. M. Mathews of Harris Calorific Co. recently returned to Cleveland from a business trip which took him to Rochester, Albany, Montreal, Boston, Baltimore and Chicago.

—30 Years Ago—

The St. John X-Ray Service Corp., Long Island City, N. Y., has installed what is said to be the first X-ray plant of its kind at the Barberton, Ohio, works of Babcock & Wilcox Co.

—30 Years Ago—

In an editorial entitled, "Still Pioneering," readers are reminded that "Whatever may be the special viewpoint of the individual who is interested in welding, he must keep an open mind in order to have any chance at all of keeping up to date . . . The assumption that one knows all about the subject is a dangerous one."

—30 Years Ago—

Chester L. Wright, Dewey Portland Cement Co., Dewey, Okla., won first prize and C. W. Rehback, Whittier, Calif., won second in a photo contest sponsored by Stoody Co. Entries had to depict a welded hardfacing job.

—30 Years Ago—

"Pointers on resistance welding" are given in this issue by R. T. Gillette of General Electric Co., Schenectady, N. Y.

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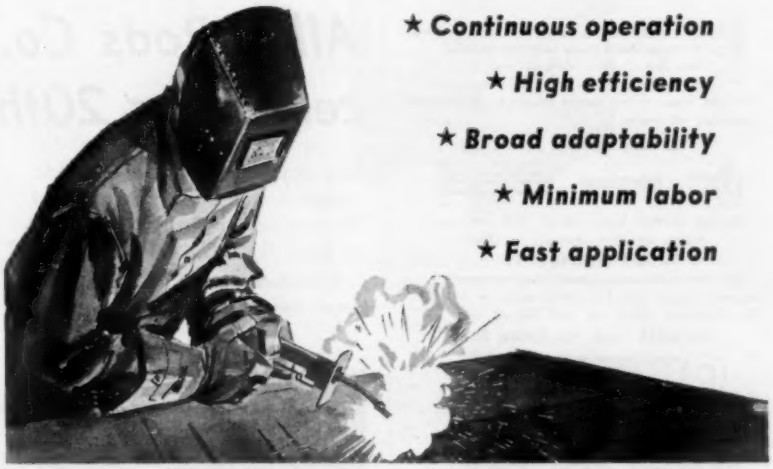

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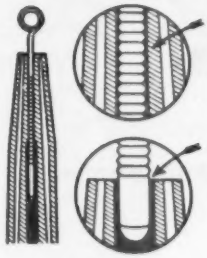
Let Your Local Welding Supply Dealer Explain Why "YOU GET SO MUCH MORE" With . . .

WYPO
Wipes and Polishes
the World's Finest
CUTTING & WELDING TIP CLEANERS

FREE! NEW, SPECIALLY DESIGNED WYPO POLISHING FILE INCLUDED IN EACH SET

More Exclusive WYPO Features



These rounded outer edges of cleaning ridges clean and polish tip orifice without scratching or cutting.

This smooth pilot guides WYPO Tip Cleaner into tip. Will not enlarge or damage tip port.

This cross section view of WYPO Cleaning Surfaces shows these exclusive features: Rounded cleaning surfaces that won't jam or cut.

Straight sided valleys insure thorough cleaning by removing all waste.

SPRING LOADED SPOOL

Spring loaded brass spool. Will not rust. Holds cleaners securely in case.

DOUBLE WOUND EYES

Insures longer life for small sizes of WYPO Tip Cleaners. Will not pull out of case.

STAINLESS STEEL POLISHING FILE

Specially designed WYPO File furnished free in each set

NOW AVAILABLE IN 3 CONVENIENT SETS

WYPO TIP CLEANERS
STANDARD SET

CLEANER NO.	FOR DRILL
7	75-74
8	73-72-71
10	70-69-68
12	67-66-65
14	64-63-62
15	61-60
16	59-58
17	57
18	56
22	55-54
24	53-52
26	51-50-49

S. S. WYPO FILE MADE IN U.S.A. PAT. NOS. 2620501, 2673750 IN CANADA 1948

STANDARD SET OF (12) Cleans (37) Drill Sizes Nos. 75 to 49 Incl.

WYPO TIP CLEANERS
JUMBO SET

CLEANER NO.	FOR DRILL
28	48-47
30	46-45
32	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
45	30

S. S. WYPO FILE MADE IN U.S.A. PAT. NOS. 2620501, 2673750 IN CANADA 1948

JUMBO SET OF (9) Cleans (19) Drill Sizes Nos. 48 to 30 Incl.

WYPO TIP CLEANERS
MASTER SET

CLEANER NO.	FOR DRILL
7	75-74
8	73-72-71
10	70-69-68
12	67-66-65
14	64-63-62
15	61-60
16	59-58
17	57
18	56
22	55-54
24	53-52
26	51-50-49
28	48-47
30	46-45
32	44-43
34	42-41
37	40-39-38
39	37-36
42	35-34-33
44	32-31
45	30

S. S. WYPO FILE MADE IN U.S.A. PAT. NOS. 2620501, 2673750 IN CANADA 1948

MASTER SET OF (31) Cleans (46) Drill Sizes Nos. 75 to 30 Incl.

Replacement cleaners and files available. Cleaning Range— Cleaner No. & Drill Nos. stamped on back of each case. WYPO GIVES YOU MORE!

SOLD BY LEADING WELDING SUPPLY DEALERS

MAITLEN AND BENSON, INC.
1395 Obispo St., Long Beach 4, Calif.

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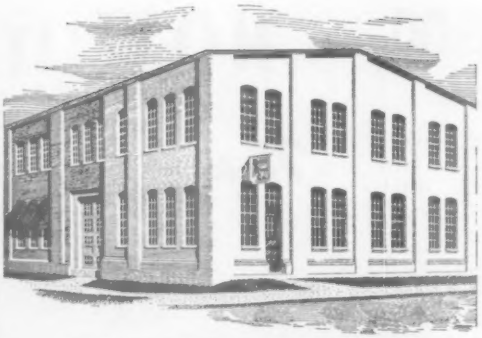

BUILDING at left housed firm's production facilities for six years. Below, partial view of present quarters which required 12 major additions since 1946.

Alloy Rods Co. celebrates 20th year

THE PURCHASE OF TWO hydraulic presses from a Brooklyn scrap yard 20 years ago marked the beginning of Alloy Rods Co., York, Pa.

Within three and one-half years, these two machines (which cost something less than their depreciated value) extruded 14,000,000 lb of stainless steel electrodes.

And in less than five years, the company reached its still-held position as the world's largest manufacturer of these primary welding products.

The stainless steel electrodes, as well as other early developments contributed by founder and president E. J. Brady, were quickly accepted by American industry. Thus, at the end of World War II, the firm's original facilities had long been outgrown.

In 1946 the company moved to its present location west of York, and since that time demands for production facilities have required 12 major additions — nine to the original building plus three new buildings. One of the latter is the modern, completely equipped research and development center.

Using a five region sales setup, the firm serves the United States and Canada through its more than 200 distributorships, and nine sales and warehouse offices.

PRESIDENT E. J. Brady stands next to one of two original extruding presses. Gilded machine has been retired to prominent position in research laboratory lobby.

6 miller WELDERS YOU SHOULD KNOW ABOUT

AEA-200-L gasoline engine driven welder/power plant/pipe thawer. 225 amperes welding current; 1 KW of 115v d-c; 5 KW of 115/230v a-c.

AD-225-L gasoline engine driven AC/DC welder/power plant. 300 amperes a-c or 225 amperes d-c welding current; 7 KW of 115/230v a-c; 1 KW of 115v d-c.

Gold Star SR Series, 3 phase rectifier type d-c welders in four models from 200 to 600 amperes. This is probably the most reliable, versatile and best performing all-around welder ever designed.

SRH — The famous Miller Gold Star series in a low silhouette welder for stacking, paralleling or to conserve space.

250 AC/DC combination transformer rectifier welder. Operates from single phase service to bring new standards of welding performance to everyone. Two a-c and two d-c ranges.

M-295 — new wide range a-c welder of horizontal design. Two welding ranges of 25-115 amperes and 80-295 amperes which handle all metals from light gauge to heavy plate.

Complete specifications on any of the above illustrated Miller welders will be sent promptly upon request. Also available are free copies of "A Full Line of Fine Welders" — a booklet illustrating and describing all our welders.

miller ELECTRIC MANUFACTURING COMPANY, INC. • Appleton, Wisconsin

Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

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CONSIDERING NEW CUTTING MACHINES?

Yes ?-----? Then before you commit yourself you should investigate

"CUT-MACHINING"

DON'T wait and BE UNHAPPY later!

Hundreds of men are more than happy with their choice of a Wallace "Cut-Machining" Unit.

Phone—Jack Voss. Collect, of course.

His bread and butter depends on how well he matches the right cutting unit to the work you must do.

With a Wallace "Cut-Machining Unit" you will get:

Pipe • Tube • Bars • Angles • Channels • Plate!
No matter what, you get . . .
2 finished ends each time you make 1 cut.
Guaranteed? Sure! Since 1896.
"You must be satisfied or you owe us nothing" has been our customers' assurance.

Phone "Jack" today.
Or if you prefer — write him.

WALLACE

SUPPLIES MFG. COMPANY

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Phone BUckingham 1-7000 (Collect, as we said before)
Chicago 13, Illinois

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Reprints from WE

Reprints of certain articles published in Welding Engineer are still available. A list of these appears below. Reprints may be obtained for 15 cents each, except where otherwise noted. Payment must accompany all orders. For quantity orders, write for special prices. Order by title from: Reprint Editor, Welding Engineer Publications, Inc., Box 28, Morton Grove, Ill.

Techniques for torch brazing aluminum
Procedures and techniques for brazing aluminum, are detailed. Includes data sheet on brazability of aluminum alloys plus four tables listing commercial products and their characteristics. This reprint is free.

Design for welding
Basic knowledge required when designing, or redesigning for welded construction is detailed and discussed. Sixteen page reprint includes 11 data sheets.

The meaning of weldability
Weldability of carbon steels and alloy steels, as well as some other metals, is discussed. Sixteen page reprint includes three data sheets.

Tungsten inert gas
A 16 page report on the history, theory and application of the Tig welding process. Includes data sheet on proper current selection. This reprint is free.

Welding of dissimilar metals
Complete details on welding dissimilar metals using NiCrFe electrodes and wires. Eight page reprint includes charts on properties, test results and data sheet on properties of other metals.

Acetylene
A 12 page salute to the IAA and acetylene, details the great success of this gas. Includes a history of the IAA and "The Acetylene Journal."

Fixtures for brazing
Presents requirements for designing brazing fixtures and materials to be used. Data sheet on properties of non-metallic fixture materials included. This reprint is free.

Selection, welding of CrMo alloy steel pipe
Discusses determining factors in selection of chromium-molybdenum alloy steels and evaluates the effects of pre- and postheat treatment on weld properties.

How to select proper regulators
Performance characteristics of equipment controlling gas flows during welding, cutting and other operations are given, as well as selection rules.

Filler metals for joining
Brazing filler metals are detailed and each group is analyzed. Includes data sheet on how to select silver brazing alloys.

Production welding controls
Discusses how material, labor and overhead effect total production welding costs, and how certain controls can result in greater time and dollar savings. This reprint is free.

New aluminum alloy not prone to brittle fracture
Extensive testing of 5083 aluminum alloy proves it has excellent weldability and weld ductility, and a good resistance to corrosion and stress corrosion. Testing for brittleness is detailed.

Explosive welding and forming open another door
A report on one of the newest entries into the welding industry, and how one pioneer company turned theories and practices into realities.

Our modern-day mythology
A rebuttal to some old-wives tales about the hazards of welding fumes, plus safety recommendations for situations where hazards might develop.

Understanding weld distortion and shrinkage
Causes of distortion and shrinkage can be determined if weld heat is understood. Eleven drawings are used to illustrate this welding problem.

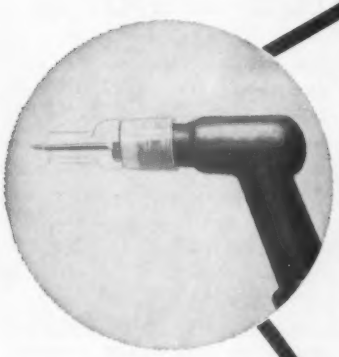
TEC PRESENTS AN UNBEATABLE FORMULA FOR TOP TIG WELDING!

TEC Visuweld Watercooled Torch

The standard bearer of the quality TEC Torch line proven by scores of satisfied users throughout the country.

Lightweight, and maneuverable, the TEC water-cooled operates from 3 to 350 Amps with maintenance free efficiency because of one-piece torch head design which eliminates troublesome wearing or leaking.

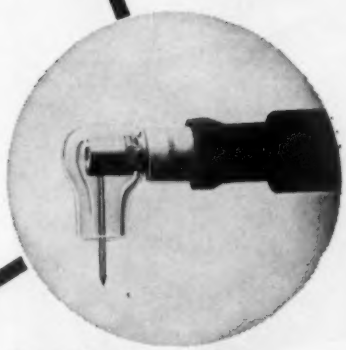
Exclusive "tip-of-torch" water cooling affords continuous welding even at 350 Amps. No finer welding instrument on the market.



TEC Air-cooled Torch

This smooth operating newcomer to the TEC line is gaining plaudits for its great gas savings and its effortless performance.

Rugged and durable due to one piece construction of phenolic plastic reinforced with macerated fiber glass, the TEC Air-Cooled utilizes both standard and off-set Visuweld transparent nozzles.



TEC Spot Gun

Here's the one spot gun that has been engineered not to create problems, but to solve the production gap between resistant welding and arc welding.

Lightweight, "tip-of-torch" cooled, and trouble-free the TEC Spot Gun enables welding all gauge thickness joints from only one side efficiently and economically.

TEC "Tiny Giant" (Pencil) Torch with Off-set Nozzle)

Only the magic of TEC ingenuity could have developed so simple, yet revolutionary an innovation.

TEC's off-set nozzles and chucks convert the TEC watercooled and air-cooled torches into miniature torches which enable TEC TIG welding in less than 1½ inches of space!

You always have the winning formula when you specify TEC for your TIG welding requirements. Dedicated to producing the finest possible equipment in the industry, TEC products have proven time and time again that they out-perform all others . . . that tig welding can be more economical, maintenance free, and can produce results never before achieved. See your nearest TEC distributor today or contact TEC directly for personal service.

** Vycor is a registered trade name of Corning Glass Works, Inc.*

TEC TEC TORCH COMPANY, INC., CARLSTADT, N. J. Manufacturers of Visuweld Equipment

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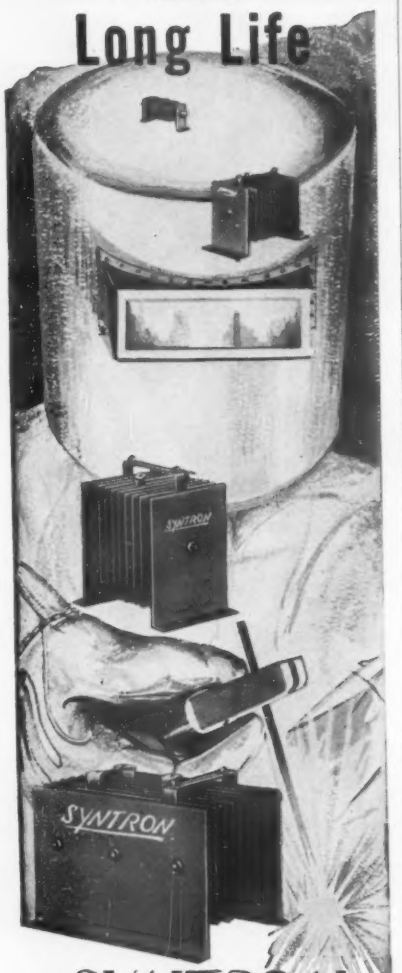
Performance and Long Life



SYNTRON

SELENIUM

WELDING

STACKS

—standard for the industry for more than seven years. SYNTRON welding Rectifier Specialists are ready to serve you.

Write for information and Specifications

SYNTRON SEMICONDUCTOR DIV.

Subsidiary of Link-Belt Company

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Sales Engineers in: New York, Chicago, Los Angeles and Canada. Canadian Manufacturing Plant: Syntron (Canada) Ltd., Stoney Creek, Ontario. Export Representative: Dage Corporation, 2192 E. 44th Street, New York, N. Y. Sales Engineering Representative: Robert Whitesell and Associates, 6620 East Washington Street, Indianapolis 15, Indiana. Offices in Cleveland, Dayton and Cincinnati.

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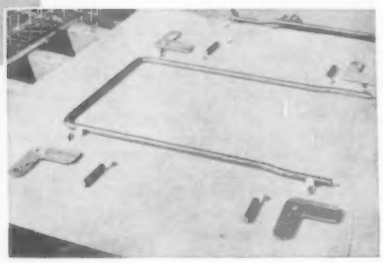
YOKE and bell crank arrangement that governs blade height can be seen at left. Small studs link crank to yoke, larger studs serve as axles for mower wheels. Below, separate elements used in yoke and bell arrangement.



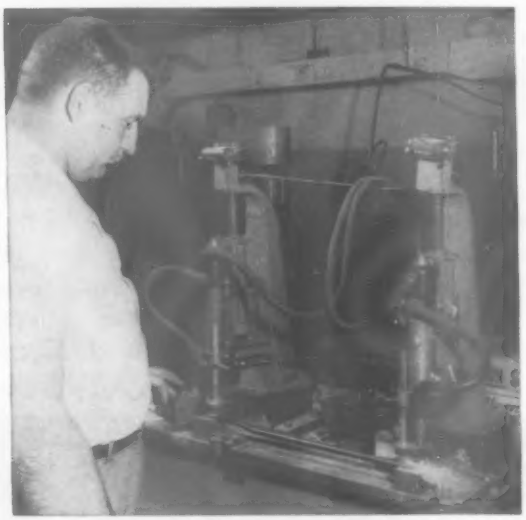
Mower adjusting mechanism simplified by stud-welding

ONCE MANUFACTURERS believe in the prowess of welding, it can turn up in almost anything. Welding's latest invasion has been in the power lawn mower field, as Huffman Mfg. Co., Dayton, Ohio, adapted stud welds to its manufacturing process.

The Hytamatic mechanism of the rotary mower uses a yoke and bell arrangement, with a pedal, to raise or lower the blade. The eight axles required are studs, applied without drilling, tapping, manual welding or other costly fabricating operations.

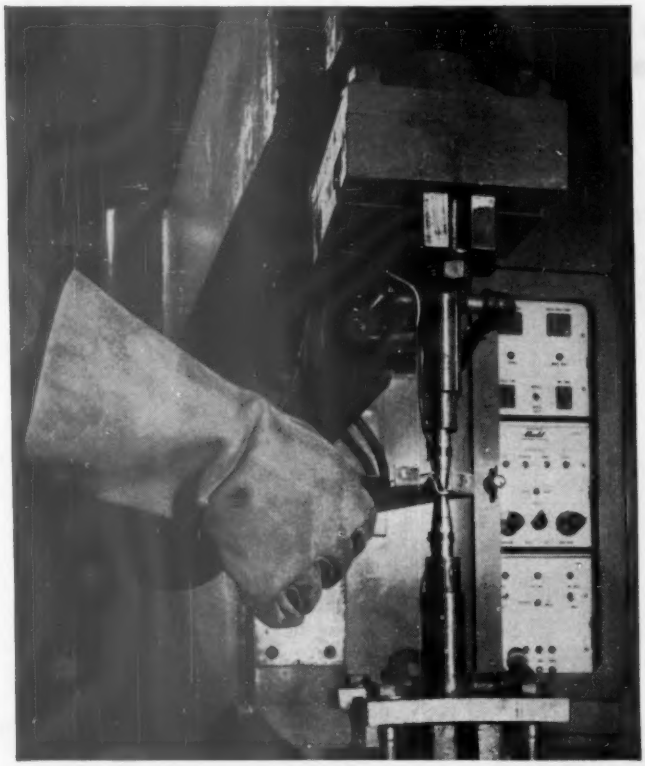
Four studs, 5/16-in. by 7/8-in., link the bell crank to the yoke. Another four studs, 7/16-in. by 2 9/16-in., are end-welded to the other end of the crank and serve as axles for the mower wheels. As the yoke is lowered or raised with a pedal and ratchet, the wheels are similarly adjusted — but raising the wheels has the effect of lowering the blade.

A special fixture and a two-gun production stud welder, manufactured by Nelson Stud Welding Div., Lorain, Ohio, are used to weld the four studs on the yoke, two studs on each side being welded simultaneously.



SPECIAL fixture and two-gun production stud welder joins four studs simultaneously on lawn mower. Studs require no hand welding or machining.

NEW FEEDBACK CONTROL
makes every weld count

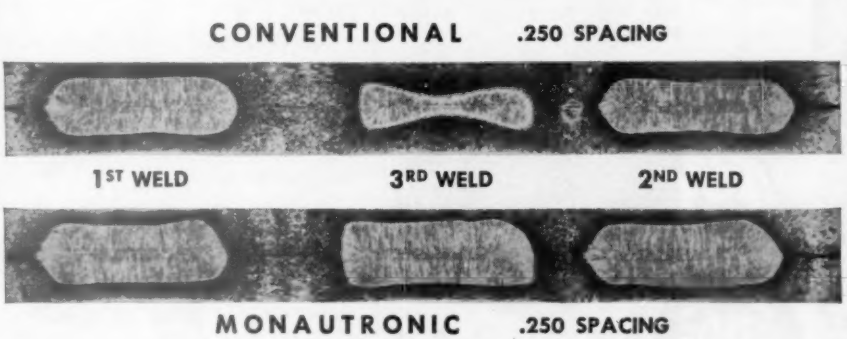


Information from electrodes is fed back to **Monautronic V-2** in background. Control has fully automatic sequencing with all provisions for single spot, roll spot and seam welding.

Now, with the new **Monautronic V-2** welding control, you can make consistently top-quality welds over long stretches of time, without stopping to test and inspect sample welds. The control senses variations in line voltage, electrode shape and tip force, material thickness and surface finish . . . and compensates for them immediately.

The **Monautronic V-2** automatically compares actual voltage across the weld with command voltage, and adjusts current accordingly to maintain voltage—and weld quality—at a constant level. If weld resistance is too high or too low to produce a good weld, the control locks out until the condition is corrected.

Although the **Monautronic V-2** embodies the latest advances in computer-type circuitry, it is quite simple to operate, and easier to maintain than most conventional controls. For complete details, contact THE BUDD COMPANY, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.



The **Monautronic V-2** overcomes shunting effects by maintaining constant voltage across each weld, regardless of how closely spaced the welds may be. Photomacrographs compare closely spaced welds made with conventional control with those made with **Monautronic V-2.** Notice how shunting of voltage has weakened the center weld made with conventional control, while **Monautronic V-2** has kept all welds uniform.

2450 Hunting Park Ave. Philadelphia 32, Pa.
12141 Charlevoix Ave. Detroit 14, Mich.
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ELECTRONIC Budd CONTROLS

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ATLAS | WIDE-BLADE TOMAHAWKS

WORLDS LEADING WELD CLEANING TOOLS

4 NEW ACCESSORIES

To Make The Welder's Job Easier!

FAST DRAW "SAFETY" HOLSTERS

MODEL 19 HOLDS ANY KIND OF HAMMER

$1.95

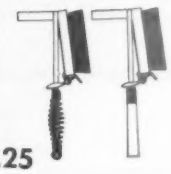
Holster made of heavy full grain saddle leather with belt loop adjustable to 5 lengths. For welders, plumbers, carpenters, millwrights.

MODEL 192 DUAL CASE HOLDS TOMAHAWK & 10 LBS. WELDING RODS

A supply of rods and the Atlas Tomahawk of your choice at your side where you can grab them without even looking. This case has a flat bottom and will stand if you choose not to wear it while working. Heavy full grain saddle leather.

$4.75

MODEL 21 FOR CARRYING ANY COMBINATION WELD CLEANING TOOL



Holds Atlas "Dual Tool" or any chipper-brush tool. Protects the welder's fingers and clothing. Prevents brush getting frayed. 5 adjustments on belt loop. Heavy full grain saddle leather.

$3.25

MODEL 15 SAFETY BELT

Heavy webbing with rust proof ring and snap. Wear it over your coveralls as a belt or shoulder strap to carry equipment.

$2.25

Tough as they come!

Atlas makes 33 different weld cleaning tools. There's one for every purpose and preference—Ask your welding supply dealer to show them to you.

ATLAS

WELDING ACCESSORIES INCORPORATED

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FERNDALE 20, MICH.

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Pipeline News

The Federal Power Commission has granted Natural Gas Storage Co. of Illinois, Chicago, and Texas Gas Transmission Corp., Owensboro, Ky., temporary authority to construct and operate natural gas facilities at a combined cost of more than $3 million. The two projects, which are not related, will be in Kanakakee and Grundy counties in Illinois and in Louisiana.

Manufacturers Light and Heat Co., Pittsburgh, has received FPC approval to build about 103 miles of 20-in. pipeline in Pennsylvania at an estimated cost of $7,703,000.

Ohio Fuel Gas Co., Columbus, Ohio was authorized to construct facilities in that state totaling $1,225,250.

FPC authorization was granted to Atlantic Seaboard Corp., Charleston, W. Va., to build 13.3 miles of 26-in. line at various locations in Virginia. At the same time, Transwestern Pipeline Co., Houston, received a budget-type authorization permitting construction during 1960 of facilities at a cost not to exceed $3 million.

El Paso Natural Gas Co., El Paso, Texas, has received temporary authority to construct and operate a total of 3,470 compressor horsepower facilities at an estimated cost of $1,454,000.

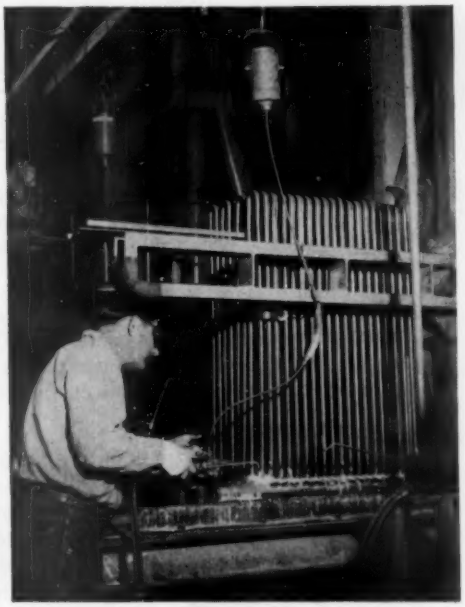
FPC authorization was granted to Transcontinental Gas Pipe Line Corp., Houston, for $3 million worth of facilities in a 12-month period.

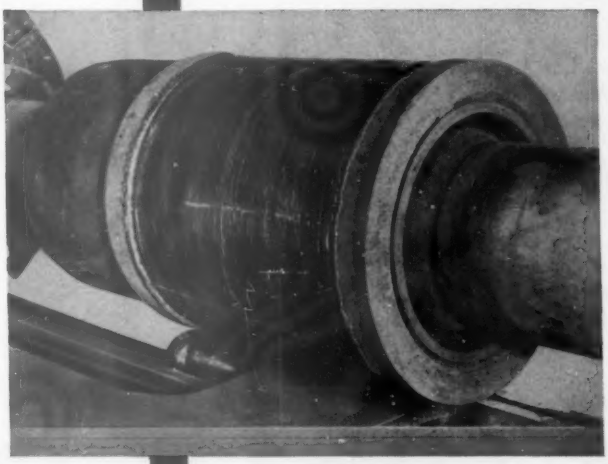
Peoples Gulf Coast Natural Gas Pipeline Co., Chicago, has gained permission to construct facilities not to exceed a total of $1,500,000 during 1960, with the cost of any single project limited to $375,000.

Equitable Gas Co., Pittsburgh, has filed an application with the FPC seeking authority to construct about 31.7 miles of 16-in. and 26.75 miles of 20-in. pipeline in West Virginia and Pennsylvania.

FPC approval has been granted for the construction of natural gas pipeline facilities at a combined cost of about $5,972,000 by Tennessee Gas Transmission Co., Houston, and United Gas Pipe Line Co., Shreveport, La.

These are... COAST ALLOYS AT WORK





A nickel base spray brazing powder that makes possible an entirely new method of assembling heat exchangers at low cost—an automatic welding wire that provides longer wearing hard facing for table run out rolls in steel mills—a cast, abrasion and heat resisting alloy that greatly extends the life of bar mill entry guide rolls—these are typical Coast Alloys at work, saving dollars for industry.

If you've a problem in combating wear, heat or corrosion in critical parts of machinery or equipment—if high temperature brazing holds possibilities for you as a better, more economical means of product or parts assembly—Coast Engineers can help. For nearly 25 years Coast Metals, Inc. has specialized in developing tailored alloys to meet specific requirements of this type.

Write today for detailed information.

COAST METALS, INC.

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COAST METALS CANADA (LTD.), HAMILTON, ONT.

HARD FACING WELDING RODS • ALLOY CASTINGS • BRAZING POWDERS

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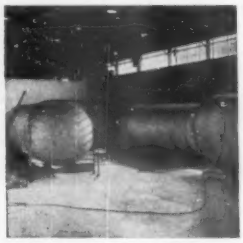
News Shorts . . .

Allis-Chalmers Mfg. Co., Milwaukee, will design and build a nuclear research and test reactor in the Union of South Africa. Work will be done jointly with the **Roberts Construction Co.** of South Africa . . . **Harper-Leader Inc.**, Waterbury, Conn., is making available a new plasma spray coating and fabrication process which can deposit nearly any material on metal ceramics and certain plastics . . .

Eutectic Welding Alloys Corp., Flushing, N. Y., recently opened its newest and largest service and training center at 3901 M. St., Philadelphia. The facility will serve as headquarters for the company's middle Atlantic division while it offers customer educational programs on the latest metal-joining techniques . . .



Standard Steel Corp., Los Angeles, is making stainless steel propellant storage vessels to be used by Aerojet General Corp., Azusa, Calif., for its Titan II missle engine testing facility near Sacramento. The vessels (see cut) range in capacity from 11,360 to 26,250 gal. . . . **Harper Trucks, Inc.**, Wichita, Kan., has warehoused its complete line of welding cylinder trucks at West Caldwell, N. J. The stock arrangement is maintained by Harper's companion company, **Tweco Products, Inc.**, Wichita. . . .

Production and distribution of chemical specialties products has begun by **Pennsalt Chemicals Corp.**, Philadelphia, at a new 34,000 sq-ft plant just completed in Atlanta. The fourth modern blending, warehousing and distribution center designed and constructed by Pennsalt since 1955, the new plant will serve the Southeast with the company's full line . . .

Riegel

. . . the preferred glove among skilled welders

TOPS IN DOLLAR VALUE

CHOSEN BY SKILLED WELDERS for extra heat protection, greater finger dexterity, and all-around comfort. Horsehide and "Flextan" leathers stay soft after dry-cleaning. Exposed seams completely welted. Seamless backs.

CHOSEN BY EXPERIENCED BUYERS for soft, sure comfort, longer wearability, excellent price, and quick acceptance in the plant...backed by Riegel's ready service and quick delivery.

COMPLETE LINE for any welding need. Let Riegel's specialists help match the right glove to the job. Ask for free catalog.

HEAVY WELDER No. 997
Top quality green "Flextan", lined for heavy, hot jobs.

WELDERS MITTEN No. 987
Green "Flextan" leather, excellent protection, flexibility of finger movement.

SPOT WELDER No. 897
For lighter jobs, unlined green "Flextan" leather.

GENUINE HORSEHIDE PALM No. 956
Horsehide Palm, clute pattern cut extra long to prevent wrist chafing, and fourchetted for extra comfort and dexterity. Welted and wool-lined for complete protection.

RIEGEL TEXTILE CORPORATION • Conover, N. C.

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AROUND

General Cable's rubber-insulated welding cable is so flexible you can run it almost anywhere. It provides excellent resistance to abrasion, twisting, impact, heat, moisture and weather. Our neoprene-insulated welding cable extends this durability by also resisting flame and oil. And for really heavy-duty use, our Super Service welding cable combines unusually-fine strand construction with a heavy-duty, mold-cured neoprene insulation-jacket. This Super Service type complies fully with all of the applicable IPCEA standards. General Cable also manufactures a superior Welder Power Supply Cable to complement its regular line of welding cables. Call your authorized General Cable Distributor for full information.

GENERAL CABLE CORPORATION

730 Third Avenue, New York 17, N.Y. ■ Offices and Distributing Centers Coast-to-Coast

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News Shorts (Cont'd) . . .

Zirconia (ZrO_2) coating is now available for application by the **Linde Co.** (New York City) Plasmarc plating process. The coating will be used primarily for insulating purposes . . . **Linde** recently signed a contract to supply up to 100 million cu ft of oxygen per month to the **Sheffield Div., Armco Steel Corp.**, Middletown, Ohio. The gas will be produced by a new plant, which Linde will build and operate in the Houston, Tex., ship channel area . . .

A pressure-compensating regulator designed for welding and cutting apparatus is reported having been successfully used in a new type manometer that measures and records river and reservoir stages. The manometer, produced by **Scientific Instruments of Wisconsin, Inc.**, Milwaukee, measures water depth by use of a pressure-sensing device installed in the stream or lake. The regulator, made by **National Cylinder Gas Div., Chemetron Corp.**, Chicago, was selected to control the amount of gas in the device . . .

Allbright's, a distributor serving Riverside and San Bernardino counties, Calif., has a new welding and industrial sales center and a new name. The firm, now known as **Welding and Industrial Sales, Div. of Allbright's**, is headquartered in a 50- by 150-ft building located on a 2½-acre site in the industrial section of Riverside . . .

Plastic steel and other industrial maintenance, repair and tooling products are now available in Canada from a newly formed company, **Devcon Ltd.** . . . The welding supply division of **H. M. Parker & Son**, Glendale, Calif., recently moved into new headquarters at 11245 Van Owen St., North Hollywood. The building site totals 86,000 sq ft and includes a warehouse, sales and administrative offices, modern showroom, and off-street parking . . .

ROBVON BACKING RINGS

APPROVED FOR WELDING PIPE, VALVES, AND FITTING JOINTS

ROBVON TYPE "CCC" BACKING RINGS

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Designed for quick easy alignment of pipe where the variation in inside diameters is relatively great. Chamfered NUBS allow close tolerance fit-up and CLEAN STRIKE OFF. The ROBVON NUB automatically sets root gap. ROBVON rings are beveled to assure non-restricted fluid flow. Available in Carbon Steel, Wrought Iron, Chrome Alloys, Stainless Steel and Aluminum.

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MAIL COUPON FOR DETAILS

Page Steel and Wire Division (Dept. WE)
American Chain & Cable Company, Inc.
Monessen, Pa.

Please send me details on PAGE automatic welding wire as follows:

☐ Have salesman call

☐ Send Booklets **DH-402** and **DH-1218** with details on PAGE welding wire

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

ONLY PAGE OFFERS ALL THESE ADVANTAGES!

The wire that meets your production needs • Good automatic welding demands these two wire qualities: a wire analysis which gives the best match to the metals to be welded, and wire uniformity. You get both when you use PAGE welding wire. From a full 33 analyses—the largest selection available from any manufacturer—PAGE can supply the right wire for *your* welding job. We also can develop *special* wires for particularly tough welding operations. And regardless of the wire that's best for you, you can count on PAGE uniformity—consistent metallurgical quality, accurate size, proper finish.

Coil identification to speed up production • Liner markings on each coil of PAGE welding wire provide positive identification, end mix-ups. And on #2 coils, liners are color-coded as well. The color of the stripe indicates the grade, makes identification double-quick and fool-proof.

Packaging that keeps production flowing smoothly • PAGE supplies welding wire in every form of packaging for modern production methods. You can specify PAGE wire in 25 lb. coils or reels—on up to 1200 lb. Payoff-pallets. Special packaging available when required.

GET THE COMPLETE STORY!

Mail the coupon at top—or write us describing your welding requirements. We'll be glad to help you select the right welding wire analysis and packaging for your operation.

PAGE WELDING WIRE

ACCO

Page Steel and Wire Division
American Chain & Cable Company, Inc.
Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*, Los Angeles*, New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn.
**Indicates PAGE warehouse stocks*

PAGE —the source for answers to welding problems

For more facts Circle No. 193 on Reader Service Card

About people . . .

James F. Ryan has been placed in charge of welding and brazing sales for Whitehead Metals, Inc., New York City. He is succeeding *John T. Stewart*, who will devote his time to new product development.

Ryan

Smith

Albert J. Smith was recently elected vice president of the McKay Co., Pittsburgh. He has been with McKay since 1949.

Dr. Charles H. Moore has been appointed technical director of the Copper Products Development Association, Inc. His office will be in New York City.

At Alan Wood Steel Co., Conshohocken, Pa., senior vice president *Perry L. Francis* recently retired from active service after 36 years with the company. *Joseph Toth* has been appointed Philadelphia district sales manager, and *William T. Haddon, Jr.*, has been named assistant general manager for steel sales.

At Union Carbide Corp., New York City, three recent changes took place: *Hermann K. Intemann* was named director of purchases for the company. *William H. Feathers* was appointed president of Union Carbide Metals Co., and *James R. Johnstone* was made president of National Carbon Co., divisions of Union Carbide.

The Bernard Welding Equipment Co., Chicago, elected the following officers at a recent board of directors meetings: R. A. Bernard, president; A. A. Bernard, chairman of the board; Mrs. M. M. Bernard, secretary-treasurer.

At their fourth annual meeting, held in Detroit recently, members of the Resistance Welding Alloy Association elected *H. A. Mullen* president, succeeding *James C. Cox* of S-M-S Corp., Birmingham, Mich. Mullen is manager of the resistance welding department of Ampco Metal Inc., Milwaukee.

Mullen

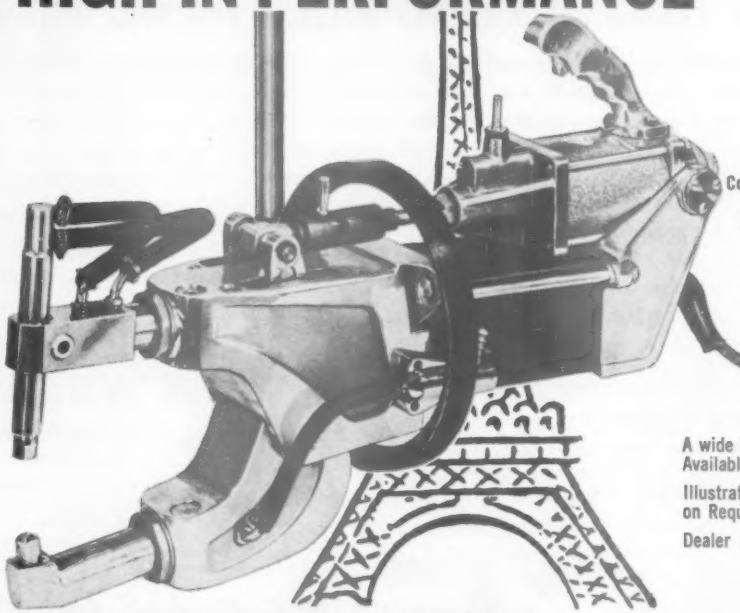
Price

General Dynamics' Liquid Carbonic Division, Chicago, has promoted *William E. Price* to division advertising manager. He has been Liquid Carbonic's equipment sales manager for the past four years.

M. R. Cashman has been appointed district manager of the Creighton, Pa., office of Air Products, Inc., Allentown, Pa., succeeding C. W. Doumont.

NEW MODÈLE #407 REACHES NOUVEAU HIGH IN PERFORMANCE

14,000 amps • high pressure • welds from lightest gauge up to 2 x ⅛" • fully automatic single and repeat action • air operated • water cooled • ski-lift type gyroscopic suspension • 10" throat. Extension arms up to 30" available.



Complete with Timer

$1720

F.O.B.—L.I.C.

Subject to change without notice.

A wide Variety of Models Available for Every Job.

Illustrated Literature on Request.

Dealer Inquiries Invited.

ARO

ARO SPOT WELDER DIVISION Guthery Machine Tool Corporation

38-31 CRESCENT STREET, LONG ISLAND CITY 1, NEW YORK

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Best in Sight...

Wherever Ventilation is Required

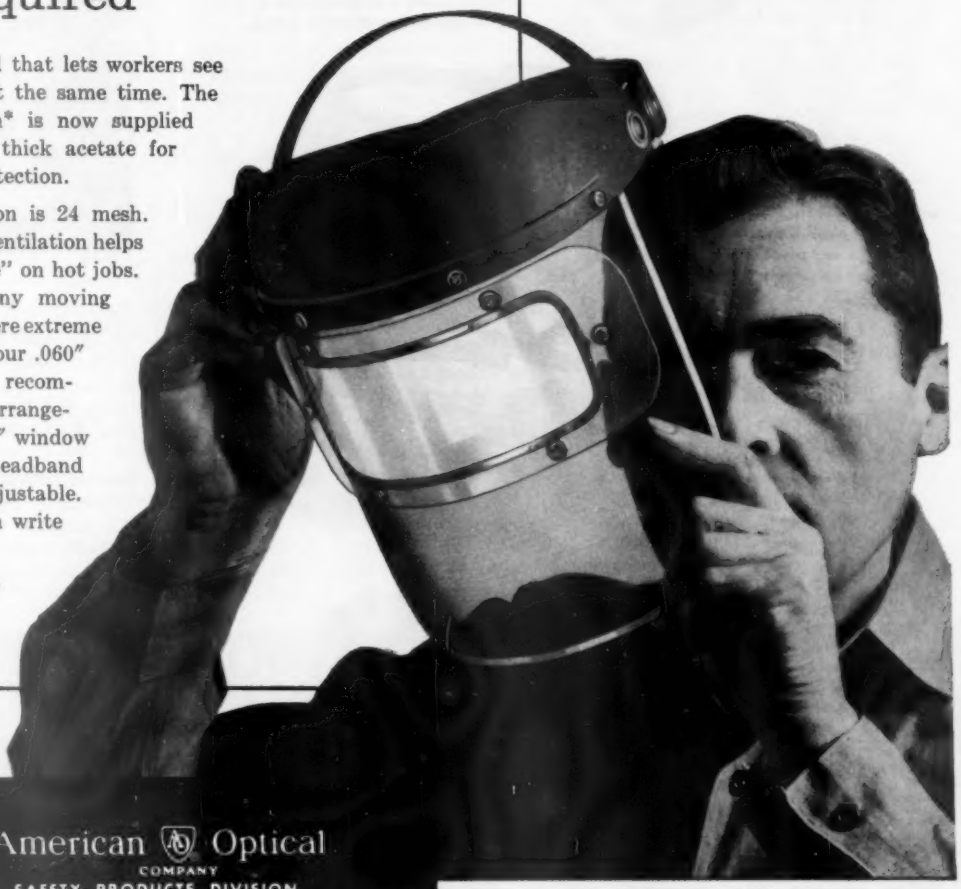
Combines...

- **Vision plus Ventilation**
- **High Protection from Impact or Heat**
- **Window Replacement Economy**

This is the face shield that lets workers see well and keep cool at the same time. The clear window portion* is now supplied standard with .040″ thick acetate for additional impact protection.

Durable screen portion is 24 mesh. The resultant added ventilation helps a man's skin "breathe" on hot jobs. He'll benefit from any moving air. For operations where extreme impact is a problem, our .060″ thickness acetate is recommended. Turnbuckle arrangement on sides of .060″ window anchors safely. Back headband of the Kool-Vent is adjustable. For more information write for folder S-9033.

*Smaller than a full size window, it is more economical to replace.



AO 283 KOOL-VENT
Face Shield

American Optical
COMPANY
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASSACHUSETTS
Safety Service Centers in Principal Cities.

For the Right Touch on Production Welding ...this AO Elkskin Glove

Very soft, very flexible — for jobs where sensitivity of touch is a must. These gloves reduce hand fatigue and will give plenty of "mileage" despite high temperatures. Montpelier pattern, one-piece back and palm, all welted seams, heavy lining on back, 14″ long.

5 x 311 ELKSKIN GLOVE

Always insist on ® Trademarked Safety Products. Your Nearest AO Safety Products Representative can supply you.

Your Surest Protection...AO SURE-GUARD Products

For more facts Circle No. 195 on Reader Service Card

S-42 Chippers Goggle with flat, or 6:00D Bal-SAFE lenses, clear or in Ray-Ban shades 1, 2 or 3.

W-35 Chippers Eyeshield with two Enduron 2"x4¼" plates; gives increased protection and provides air space which further reduces fogging.

S-41 Welders Goggle with Arc-Ban lenses in shades No. 3 through No. 6, with tough Enduron plastic cover lenses.

W-36 Welders Eyeshields with 2"x4¼" Arc-Ban welding plate, shades No. 3 through No. 6, with Enduron cover plate.

RARE NEW COMFORT, ADDED PROTECTION, IMPROVED VISION

Bausch & Lomb Chippers and Welders
FLEXIBLE GOGGLES AND EYESHIELDS

Insure workers a greater degree of safety than ever before; give them more comfort, better vision. Insure more worker cooperation, too, because these goggles and eyeshields are so good looking in their new opaque flesh color and bright nickel louvers, vents and head bars!

Soft and flexible, they fit snugly, comfortably. Eyeshield plates are replaced in seconds through side opening. Goggle head bars are adjustable as are two-tone elastic headbands. For more details, prices, write today: Bausch & Lomb Incorporated, 98709 Lomb Park, Rochester 2, New York.

BAUSCH & LOMB

Protection-PLUS Safety Products

protection + economy + worker acceptance

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Lou S. Benhart, formerly with Smith Welding Equipment Corp., Minneapolis, is presently industrial equipment supervisor for the west central region, Liquid Carbonic Div., General Dynamics Corp., Chicago.

Benhart

Norcross

James E. Norcross has been elected to the board of direcors of Arcos Corp., Philadelphia. Norcross, executive vice president of the company, fills a vacancy left by the recent death of *Royal D. Thomas.*

Named manager of the cryogenics division of Standard Steel Corp., Los Angeles, is *Thomas A. Carter, Jr.* Before joining Standard, Carter was employed as a mechanical engineer.

Robert J. Songer has been appointed sales engineer by Denton & Anderson Corp., direct representatives for Induction Heating Corp., Brooklyn, N. Y. Songer will work in Chicago and adjacent Illinois and Indiana counties.

Harold A. Hallstein, Jr., has been named as general field sales manager of Gregory Industries, Inc., Lorain, Ohio. With Gregory since 1946, Hallstein served as Cleveland manager from 1952 to 1958.

Eastberg

Stucky

A. M. Eastberg has been added to the staff of the welding products division of A. O. Smith Corp. and will serve in the Milwaukee office. *V. E. Stucky* joined the Kansas City, Mo., district office. Both men have many years' experience in the welding field.

Black & Decker Mfg. Co., Towson, Md., has announced the following appointments: *Jack C. Jolley*, to hardware division sales representative in the Los Angeles district; *James R. Moore*, to hardware division sales representative in the St. Louis district; *Edwin R. Hassell*, to industrial-automotive sales representative in the New York district; *John H. Beaumont*, to San Francisco branch service manager; *David S. Stevens*, to Seattle acting branch service manager.

Under a realignment of top management at Black & Decker, recently, *Alonzo G. Decker, Jr.* has been elected to serve as president. *Robert D. Black* will continue as chairman of the board, chairman of the executive committee and as firm director, and will be the chief executive officer of the company. Succeeding Decker as executive vice president is *W. Griffin Morrel*, president and director of the Chesapeake and Potomac Telephone Co.

Additional B & D appointments include the following: *Gordon N. Anderson*, hardware sales representative, Chicago district, replacing *Bernard M. Christy*, who has resigned; *James A. Smith*, industrial-automotive sales representative in the Los Angeles district; *J. Prendergast*, branch service manager at the newly-opened factory service branch at San Diego, Calif.; *George Rudat*, branch service manager at the Chicago factory service branch, replacing *A. A. Lazar*, who has resigned; *Charles L. Perz*, branch service manager at the Pittsburgh factory service branch, following Rudat's move to Chicago.

Andrew B. Holmstrom has retired as vice president of Norton Co., Worcester, Mass. With the firm 41 years, Holmstrom was a vice president since 1944.

Albert Rozensky has joined the corrosion engineering products department staff of Pennsalt Chemicals Corp., Philadelphia, as a service engineer.

Recently named president of Acoustica Associates, Inc., Los Angeles, was *Frank P. DeLuca, Jr.* *Robert L. Rod*, founder and president of the firm, will assume the newly-created position of board chairman.

Oakite Products, Inc., New York City, has appointed *Daniel B. Lamb* Detroit division manager. He replaces *Thomas R. Smith*, who retires after nineteen years as head of the division.

R. P. Stuntz has been named manager of field sales and *L. D. Christie, Jr.*, was named product manager, technical sales of the Refractories division of Babcock & Wilcox Co., New York City. Stuntz will assume direction of the divisions district sales personnel, agents, distributors and dealers. Christie will program and direct field testing and evaluation of new products and provide technical services to field sales personnel.

Donald A. Leach, vice president and regional sales manager of Chicago Bridge & Iron Co., Chicago, retired recently after nearly 40 years with the firm. He will remain a director. Succeeding him, as manager of the central sales region and the Chicago district sales office is *George S. Trees*. CB & I also announced the appointment of *J. W. Hoerner* as manager of the Pittsburgh district sales office.

"DURO is the coolest"*

*says Ben Ruff of Reed & Graham, Inc. "Before I had to change holders whenever the one I was using would get hot. Now, with DURO, I can weld a whole shift without the holder getting hot to my hand, even when using 5/16 in. hardfacing electrodes at high amperages."

DURO will do the same for YOU

Proved by 28 years of welder's preference

- The Duro Electrode Holder has served the welding industry since 1932. It is famous for long life, positive grip and perfect balance. All parts are easily renewed. Semi- or fully insulated. Duro is available in 250, 300, 400, 500 and 600 amperes capacity.
- Cool operation — cool handling. Featuring "Long Jaw Design" for reaching those "hard to get at places."

THE DURO "STANDARD"

- Another feature is the square guard. It protects hands from heat and also prevents rolling and grounding when placed on a flat surface. There when you need it, is a hex key fitted into the brass core and held in place by the fiber handle for making fast cable connections.

DURO ENGINEERING COMPANY
31 OREGON AVE. · HAMDEN, CONN.

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New products . . . use card on page 99

Ultrasonic welder

Self-tuning ultrasonic seam welder for aluminum foil and other thin metals can be applied in a system with one generator serving several welding heads. Available with traversing heads for rolling mills and other applications where the seam crosses a stationary web, or stationary heads for package sealing or other operations along a continuously moving web. Special output transformer permits transmission of ultrasonic power over long cable lengths. Material as thin as 0.00017-in. as as thick as 0.006-in. has been successfully joined with unit. Dissimilar metals, and metals of different thicknesses, can be joined without difficulty, states manufacturer. *International Ultrasonics, Inc.*

Circle No. 1

Temperature indicators

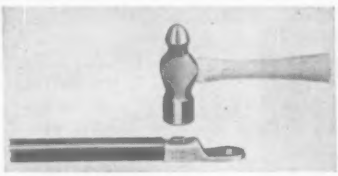
Eighteen temperature indicating crayons provide measurements from 150 F to 1240 F, and 36 paints cover a measurement range from 104 F to 2,462 F. Thirteen of firm's paints undergo multiple color changes at different temperature levels. Crayons available in complete assortment of 18 with holder; paints available in 4-oz or 1-lb cans. *Air Reduction Sales Co.*

Circle No. 2

Wide flame torch

No. 25 torch has a wide flame range that eliminates the changing of tips to achieve various torch capacities. Flame ranges from a pencil point shape 3-in. long to a lapping 12-in. flame, 1½-in. in diameter, which has excellent wrap-around qualities and is ideal for soldering copper pipe fittings up to 3 in. Unit also has an air ring adjustment which can be used in extremely cold weather, when gas pressure is low, to stabilize performance. With 40-lb pressure, the ring can be closed to produce a flame 8-in. long and 1¾-in. in diameter. *Insto-Gas Corp.*

Circle No. 3



Cable connectors

"RED-E" lugs and splicers are easily installed by inserting the stripped cable and driving down a self-contained impact punch with an ordinary hammer, thus eliminating use of special crimping tools, wrenches, and soldering equipment. Connections have more pull-out strength, higher electrical conductance and tighter seal to cork out corrosive air and liquids than connections made by all other compression type or bolted type methods, manufacturer states. Available in full range of sizes. *Bernard Welding Equipment Co.*

Circle No. 4

Silicon rectifier stack

New silicon rectifier stack, using standard and reverse polarity double diffused diodes are available with style 40 or 51 diodes. Bridge assemblies using style 40 are rated up to 180 amp single and 270 amp three phase. Bridge assemblies using style 51 diodes are rated up to 260 amp single phase and 390 amp three phase. Assembly design permits rapid adaptation to any type of current configuration. *Syntron Co.*

Circle No. 5

Electron furnace

Electron beam furnace is capable of melting, alloying, and refining ingots of up to 50 lb in tantalum, and of proportionate weights in other reactive and refractory metals including molybdenum, columbium, tungsten, thorium, cobalt, nickel, and hafnium. Designated Model 2460, the bombardment-type vacuum furnace will produce ingots up to 4-in. in diameter and 14-in. long. Auxiliary pumping system maintains a pressure level of 10^{-6} mm Hg in the gun chamber, which is water jacketed and separated from the furnace chamber by a seal that contains an aperture for the electron beam. Main power supply is a 60 kw unit delivering up to 3 amp at voltages up to 20,000. *NRC Equipment Corp.*

Circle No. 6

Flux-coated rods

Flux-coated brazing rods utilize special non-fuming non-charring material that will not crack off even when rod is bent over 360 deg. One type is thin-coated for high-speed production lines and the other is heavier-coated for general use. Non-hygroscopic flux coating allows unlimited storage of rods. Packaged in tough 10-lb tubes, rods are available in following sizes: 3/32-in. x 36-in.; 1/8-in x 36-in.; 3/16-in. x 36-in.; and ¼-in. x 36-in. *All-State Welding Alloys Co., Inc.*

Circle No. 7

Air remover

Air exhauster is composed of a special intake nozzle which is joined to a jet pump casting by a length of flexible tubing. From this point, smoke is exhausted through another connecting section of tubing to any discharge point. Unit is powered by entirely compressed air. If required, additional lengths of tubing may be added with no reduction in velocity or volume of smoke removed. *Arcair Co.*

Circle No. 8

Resistance regulator

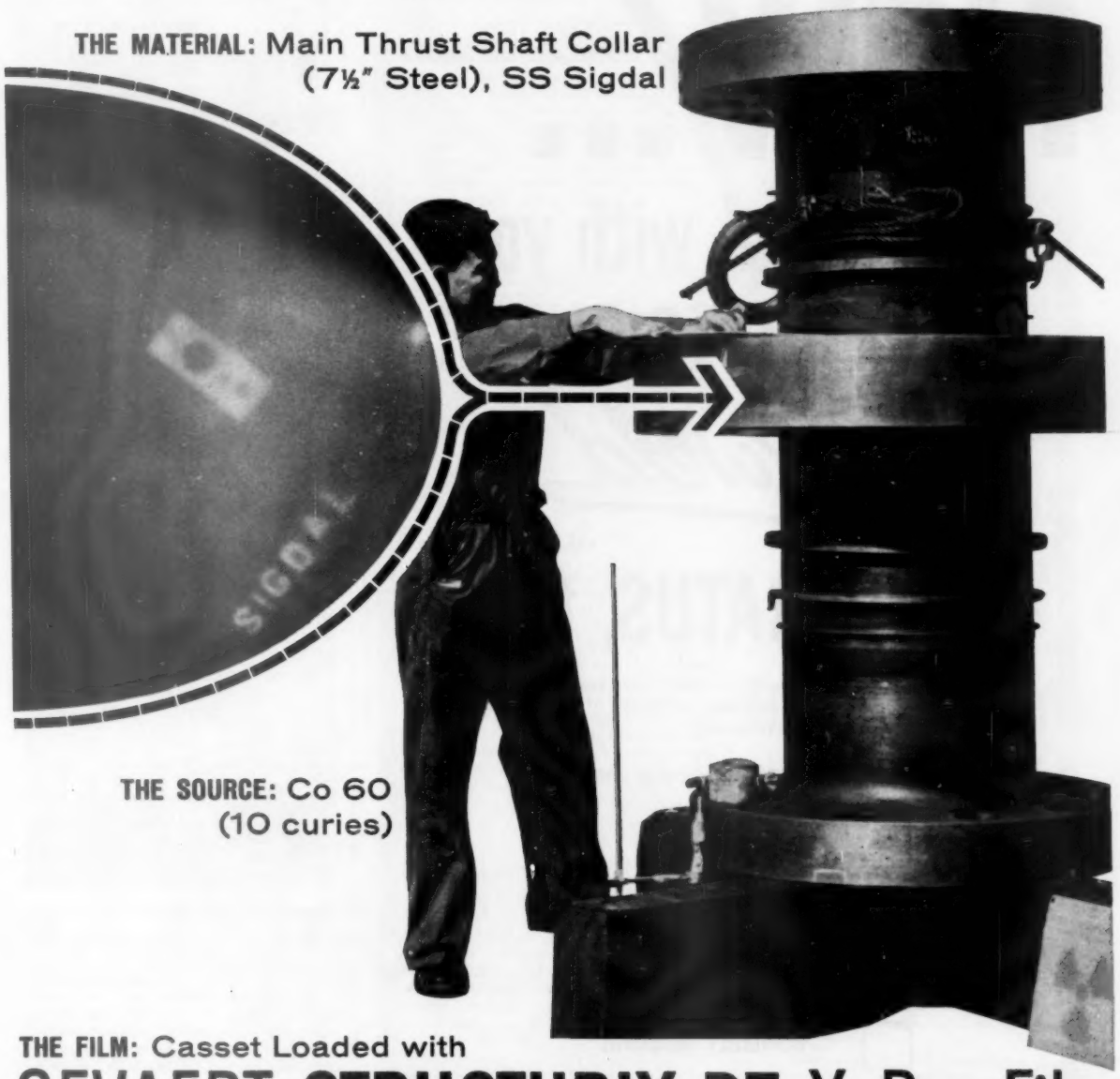
Redesigned current regulator for resistance welding control compensates for three factors that could change current: line voltage fluctuations, varying load impedance, or reactance changes caused by entrance of a work piece in the welder throat.

Electronic circuitry advances or retards the firing of the ignitron contactors to keep the root-mean-square of each welding current pulse within plus or minus 3% of its preset value. Speed of correction is 2 or 3 cycles. *General Electric Co.*

Circle No. 9

THE TEST: Radiographic Examination, Todd Shipyards Corp. (Bklyn. Div.)

THE MATERIAL: Main Thrust Shaft Collar (7½" Steel), SS Sigdal



THE SOURCE: Co 60 (10 curies)

THE FILM: Casset Loaded with

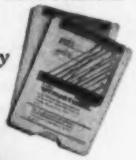
GEVAERT STRUCTURIX D7 X-Ray Film

In a recent gamma ray examination by N.Y. Testing Laboratories, Inc., (in accordance with MIL-STD-271A requirements) the film chosen for optimum penetration was Gevaert's STRUCTURIX!

Whenever radiographic tests of product structural quality are conducted in a laboratory or field, industry relies on Gevaert STRUCTURIX films for the searching "look". These films probe ever deeper in their search for hidden flaws . . . and offer greater readability, as well as a sturdy base that facilitates handling ease.

Gevaert STRUCTURIX Films are available in five types, each designed to excel in its specific job application. Your inquiry for complete details and professional samples will be answered by the nearest Gevaert branch.

FREE! *Write for a Handy Exposure Calculator for either Co 60 or Ir 192 Radiography of Steel. Specify the one desired!*



GEVAERT

THE GEVAERT COMPANY OF AMERICA, INC., *321 West 54th Street, New York 19, N. Y.*
District Offices: Lincolnwood (Chicago), Ill. • Los Angeles • Dallas • Denver • San Francisco

For more facts Circle No. 222 on Reader Service Card

NOW... CHECK with your LINDE DISTRIBUTOR for *Oxweld*

APPARATUS, too

With the *Oxweld* line of quality oxy-acetylene apparatus added to this list, he's your fastest, most complete source of dependable, top-name welding and cutting equipment:

- ☐ OXWELD apparatus and supplies
- ☐ PUROX apparatus
- ☐ HELIARC apparatus
- ☐ SIGMA apparatus
- ☐ UNIONMELT apparatus
- ☐ PREST-O-LITE small tanks, appliances, and acetylene
- ☐ LINDE industrial gases

Your LINDE distributor is a welding specialist, superbly equipped and stocked for immediate delivery of a full line of quality products. To his already extensive list, the *Oxweld* line adds the most efficient high quality gas welding materials available today. There's a LINDE distributor near you. Call him for *all* your welding needs. Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto.

"Oxweld", "Purox", "Heliarc", "Sigma", "Prest-O-Lite", "Linde", and "Union Carbide" are registered trade marks of Union Carbide Corporation.

Linde — UNION CARBIDE

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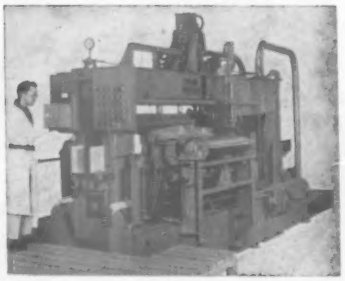


"Narrow lap" welder

Narrow-lap (mash) seam welder with horizontally retracted shear is used in continous electro-tinning, annealing, coil preparation, side trimming and inspection lines, producing weld joining ends of strips which have been overlapped only a fraction of an inch. Equipped with a double resquaring shear, welder has strip centering end alignment and other devices. It produces a continuous, sound, inconspicuous weld, says manufacturer, in material up to 48-in. width and from 0.004-in. to 0.036-in. thick. *Taylor-Winfield Corp.*

Circle No. 10

Portable nibblers

Model MNC portable nibbler permits corrugated sheets of metal to be carried from job to job, cut and fitted at installation. Nibbler also cuts small diameter duct or formed sheet metal pipe; cuts diagonally across contours without changing the shape of the piece; cuts circles of 2-in. diameter. *Fenway Machine Co.*

Circle No. 11

Hardfacing electrode

Welding electrode designed for hardfacing applications on carbon and austenitic managanese steel parts deposits a surface which resists extreme impact and severe abrasion, says manufacturer. Hardalloy 44 weld metal has an as-deposited Rockwell C hardness of from 40 to 45 on C-1020 carbon steel plate, and a hardness of from 33 to 45 on 12-14% manganese plate; deposits work harden rapidly to 52 Rockwell C. Although they are not machinable, deposits are smooth and sound, requiring a minimum of grinding. Electrodes are supplied in 5/32-, 3/16-, and ¼-in. sizes in standard 14-in. lengths and in 5/16-in. diameter, 18-in. length. *The McKay Co.*

Circle No. 12

Circle No. 200 on Reader Service Card

TILLMAN

Gloves — Garments

PACKAGED IN POLY BAGS

3 NEW GLOVES

CARPINCHO #770

CARPINCHO #775

HELIARC #24

BUY FROM YOUR DEALER

BRAZILIAN DEERSKIN THE "STAY SOFT" LEATHER GLOVES AND MITTENS

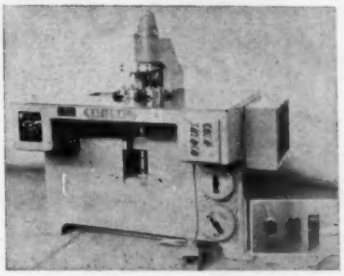
TILLMAN PRODUCTS

John Tillman & Co.
Long Beach, Calif.

Dye-penetrant

PIXchek, dye-penetrant inspection system for detecting surface flaws in wide variety of materials, is available in compact kit containing both spray and liquid cans for on-the-spot inspection. Unseen flaws are made visible by action of a chalk-white developer on a low-viscosity red dye. The dye-penetrant is drawn up by the developer from the defect to make a red stain pattern on white surface. *Picker X-ray Corp.*

Circle No. 13



Transistor welder

Automatic transistor welder is essentially a basic unit which uses standard key components and which can be tooled for either dial feed or single point operation. A 3- by 4-ft table, 32-in. high, forms the top of the unit's base and is designed specifically to accomodate a standard dry box. Conversion is accomplished by repositioning the transformer and welding heat, mounting the indexing unit and cutting a hole through the hard-surfaced composition table top. *National Electric Welding Machines Co.*

Circle No. 14

Low fuming alloy

Available in both bare and flux coated form, new low fuming bronze brazing alloy is designed for general purpose, all-around welding and brazing work. Low melting point allows free flow and produces a tough, ductile deposit of high tensile strength, according to manufacturer. *American Brazing Alloys Corp.*

Circle No. 15

Aluminum fittings

Line of cast pipe aluminum fittings have superior weldability, according to manufacturer. Cast in aluminum 356-T6, the fittings include four types of welding reducers: welding elbow, welding neck flange, slip-on welding flange and aluminum blind flange. All fittings available in six sizes, from 2- to 8-in. *Wheaton Brass Works.*

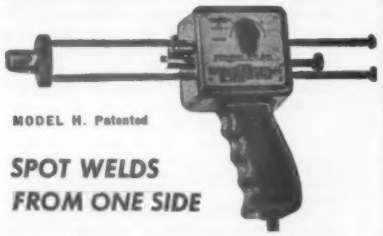
Circle No. 16

Engine generator

Engine generator with "Maxi-watt" power control offers maximum power for heavy motor loads, maximum efficiency for highly economical operation with other loads, according to manufacturer. "31" series will carry a 2,500 watt load on a single 115-volt or 230-volt circuit; or will power motors up to 1.5 hp or 2 hp. *Wincharger Corp.*

Circle No. 17

Arc Spot Weld Gun



MODEL H. Patented

SPOT WELDS FROM ONE SIDE

- AUTOMATIC TIME CONTROL
- NO EXPERIENCE NEEDED TO WELD . . . SHEET METAL • AUTO BODY WORK • SIGNS • DUCTWORK • CABINETS • TANKS • PLUMBING • ROOFING
- COMPLETELY PORTABLE
- WELDS . . . MILD STEEL • GALVANIZED • STAINLESS
  Minimum 26 ga. — Maximum 14 ga. Welded to any thickness
- NEW WIDER RANGE POWER SUPPLY
- OPERATES ON 110/1/60 cy.

BREN/WELD CORPORATION

Manufacturers of Welding Equipment
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It's GOOD BUSINESS to DO BUSINESS with your LINDE DISTRIBUTOR because...

Your LINDE Distributor carries a *complete* line of all the welding and cutting equipment and supplies you need in your business. These are products recognized for their outstanding high quality and efficiency. In most instances, he can fill your order *from stock*, to save you time and effort.

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Your LINDE Distributor is a local, independent business man—just as you are. He appreciates your business and wants repeat orders.

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Linde UNION CARBIDE

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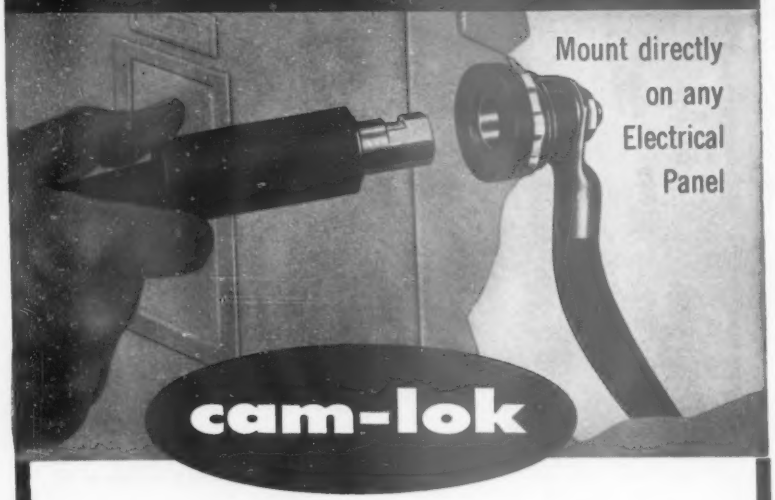
Circle No. 199 on Reader Service Card

New Hi-Impact Plastic Insulated

Panel Receptacles and Mating Plugs



Now, you can make fast, positive power connections to any metal panel or housing without special insulating materials. Simply punch out a hole and insert a Cam-Lok self-insulated Receptacle! Uses standard electrical lock-nuts, affords "dead-front" protection. Push in and twist Cam-Lok mating Plug and you've made a locked connection, which can be released quickly.

New Cam-Lok Receptacles eliminate costs of special insulating panels and reduce assembly time. Patented, high-pressure contact assures minimum resistance and heating.

Cam-Lok has a complete line of Receptacles and Plugs in many sizes and designs. Standard and special purpose Power Distribution Connections are available. Write today for new Bulletin No. 301.

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For more facts Circle No. 202 on Reader Service Card

Bracket clamp

Gas cylinders used in laboratories or set up for temporary use can be held rigidly in place on the edge of a bench with bracket clamp. Cylinder is placed vertically into the cast-iron bracket and is secured there by an adjustable webbed strap. *Central Scientific Co.*

Circle No. 18

Seam welder

Travelling head seam welder with automatic feeding, transfer and expanding units produces motor shells from flat sheets at a rate of more than 500 shells per hour, says manufacturer. Machine feeds blank sheets from a stock table into the form and weld unit where the sheet is formed into a shell and the overlap edges are seam-welded to produce a cylinder. Expanding equipment is hydraulically operated and capable of providing maximum pressure of 30 tons. Cycle time for the unit, including expanding and collapsing of the mandrel, is approximately three seconds. *Federal Machine and Welder Co.*

Circle No. 19

Silicon rectifier

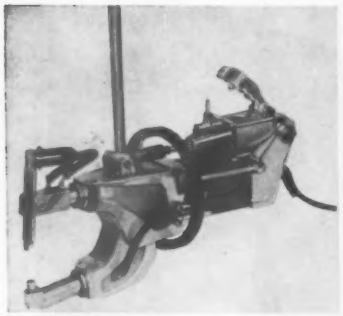
Double diffused, hermetically sealed, silicon power rectifier is rated at 80 amp average at 68 F, ambient on a 7-in. x 7-in. x 1/8-in. copper heat sink. Peak inverse voltages range from 100 to 400 volts in 100 volt steps. Typical forward dynamic resistance of 0.001 ohms is achieved by diffused junction techniques. Peak forward voltage of the diode is 1.25 volts maximum at 200 amp. Mounting torque is 600 in-lb maximum. *Syntron Co.*

Circle No. 20

E6013 electrode

E6013 electrode has small amount of iron powder added to the coating to improve arc stability on out of position welding, can be used on a-c or d-c, straight or reverse polarity. Available in 3/32-in. diameter in 12-in. lengths; 1/8, 5/32, 3/16 in 14-in. lengths; and 7/32, 1/4 in 18-in. lengths. *Hobart Bros. Co.*

Circle No. 21



Spot weld gun

Model 407 spot welding gun has a capacity of 14,000 amp, welds from lightest gage up to 2 times 1/8-in. Air operated and water cooled, unit has fully automatic single and repeat action. For extreme operating ease, gun is equipped with "ski-lift" type gyroscopic suspension. *Aro Spot Welder Div., Guthery Machine Tool Corp.*

Circle No. 22

Air draw furnace

Gas-fired or electrically heated heat treating furnace, called Rotair, is designed to meet severe operating conditions and provide accuracy in lower range heat treating. High speed fan rapidly circulates heated air at a high static pressure to quickly bring the furnace up to operating temperature and assure even temperature and pressure distribution. Fast, thorough heating is achieved, even in dense loads, according to manufacturer. Cover operation features pneumatic lift, manual swing out for easy access to the chamber. *Hevi-Duty Electric Co.*

Circle No. 23

Portable ventilators

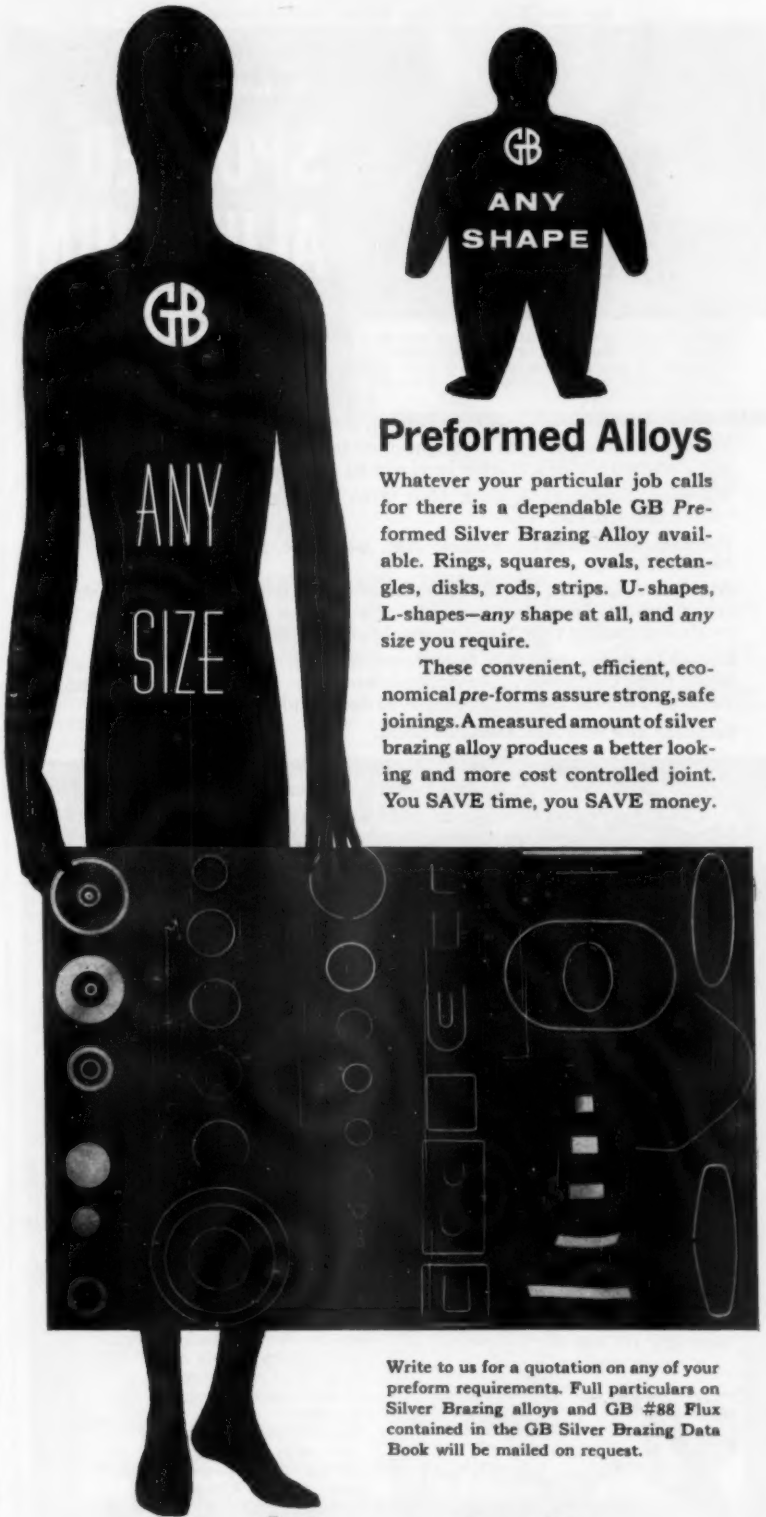
Line of portable ventilators is useful for supplying emergency air to personnel working in cramped or unventilated spaces or for cooling overheated equipment. Construction features include safety guards and carrying handles, heavy gage steel housings with reinforced flanges for extra rigidity, and wire reinforced flexible duct that mounts easily on fan flanges or snaps onto other duct sections. Propellors are cast of aluminum mangnesium non-sparking alloy and have airfoil section blades that overcome the pressure drops in the hose. One 16-in. and two 12-in. models available. *Propellair Div., Robbins & Myers, Inc.*

Circle No. 24

Corrosion killer

Formula "E", a non-acid and non-toxic fluid made from a special blend of tannins, halts corrosion by rendering metal surfaces inert, at the same time giving them a hard and burnished surface which bonds well with all recognized industrial paints and increases their covering capacity. Lightly corroded plates can be resistance welded after treatment with the fluid, while oxy-acetylene flame will burn away the tannate film without leaving slag deposits. *Plus-Gas Co., Ltd.*

Circle No. 25



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Whatever your particular job calls for there is a dependable GB *Pre*formed Silver Brazing Alloy available. Rings, squares, ovals, rectangles, disks, rods, strips. U-shapes, L-shapes—*any* shape at all, and *any* size you require.

These convenient, efficient, economical *pre*-forms assure strong, safe joinings. A measured amount of silver brazing alloy produces a better looking and more cost controlled joint. You SAVE time, you SAVE money.

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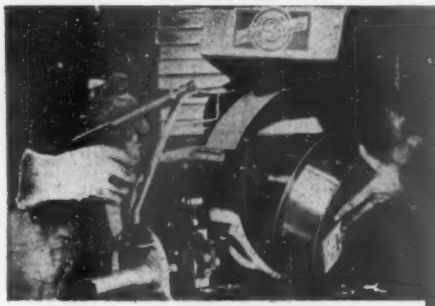
For more facts Circle No. 204 on Reader Service Card



Loading 10 lb. spool of #4043 aluminum wire at Michael Flynn Manufacturing Co., Philadelphia. Aluminum in this particular spool was used in welding curtain walls for skyscraper at 2 Broadway, New York City.

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SPOOLED ALUMINUM

in all grades, all types
precision layer level
wound on
1 lb. and 10 lb. spools

Wire goes from extrusion and light draw to ALL-STATE'S precision spooling machines where it is layer level wound for smooth, trouble-free welds.

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ALL OUR EJECTOR HOLDERS LEAK, DOC! AND I'M NOT MISTREATIN' 'EM—I'M NOT!
JOE'S NO PSYCHO, MR. FOREMAN. WHY NOT LET HIM TRY A GOLDCROWN?
GOTCHA, DOC! JOE'LL HAVE A GOLDCROWN TOMORRA!

New Tuffaloy Goldcrown Ejector Holder ends leakage. Seals are protected from shock and grit. One Goldcrown user made 25 million welds without a leaker.
Goldcrown man-size ejector head ends sticking. For Goldcrown details write your nearby Airco or Tuffaloy office.

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For more facts Circle No. 205 on Reader Service Card

Bench welder control

Midget bench welder control weighs only 21 lb, measures 6-in. wide, 10-in. deep, 10-in. high. Called model 10E76E-C, unit is used on very small welding machines which can be operated within the limits of a 12-amp, 50% duty cycle, thyraton contactor with input voltage of 115 or 230 volts, 50 or 60 cycle only. Weld time of ½ cycle, and 1 to 10 cycles, by tap switch is provided; phase shift heat control is adjustable from 20 to 100%. *Robotron Corp.*

Circle No. 26

Miniature flowmeter

Miniature flowmeter was designed for measurement of low flow rates of either liquids or gases. Interchangeability of standard parts for varying capacities simplifies procurement for O. E. M. users. Tube of the unit, called Minirator, is of the "snap-in" type, permitting a change in range in a few seconds without the use of tools. End fittings can be rotated through full 360 deg for ease in mounting and meter is so designed that it may be surface or flush mounted on a panel or installed in-line. *Fischer & Porter Co.*

Circle No. 27

Arc welder

Joining coils of steel strip to enable continuous feed into a helical pipe forming machine, this automatic welder uses a built-in shear to assure properly matching edges. Tungsten electrode and argon gas are used in butt welding galvanized strip coils to one another. Silicon bronze "cold wire" is fed into the arc to prevent porosity and reduce corrosion during later service of the galvanized pipe. *Taylor Winfield Corp.*

Circle No. 28

Tracer welder

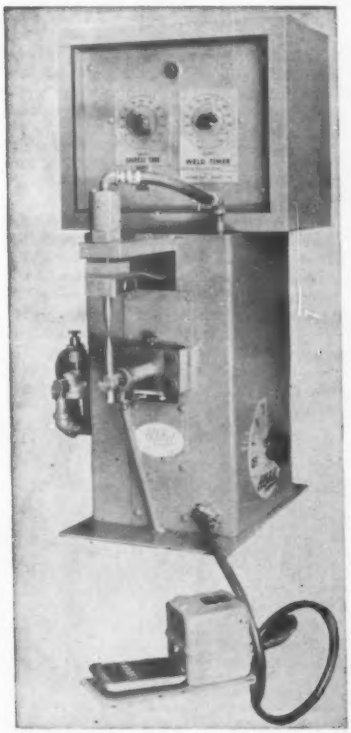
Automated mechanical follower tracer welding machine automatically follows the irregular weld line contour and welds an untrimmed "U" shaped steel plate to a "U" shaped steel rib in the production of tractor grille assemblies. Entire tracer system is mounted on and driven by a carriage. Carriage, tracer system and welding head are totally guided in the horizontal plane by a contour cam built into the machine. Unit is completely self-contained and requires no external wires, amplifiers, power sources, valves, etc., manufacturer states. *Expert Welding Machine Co.*

Circle No. 29

Welding goggles

Welding goggles eliminate dangerous blind spots. Series FS-250 have angled lenses, are available in three shades, which provide wide vision and enable worker to take in entire work area with slight tilt of the head. This, plus lightweight construction, eliminates neck and shoulder fatigue and brings increased productivity and improved safety, according to manufacturer. *National Cylinder Gas Div., Chemetron Corp.*

Circle No. 30



Bench welder

Squeeze-weld timer on bench welder permits electrodes to compress the work before welding, allowing for much finer control. Model BW, rated at ⅜- to 3 kva, measures 15-in. in height, 8½-in. in width, 9-in. in length, and weighs 90 lb complete. With a 1-in.-diameter cylinder and a 1-in. stroke, unit is capable of 0-100 lb pressure. Other features include solenoid valve, air combination regulator, oiler, filter, pressure clock, 3-step heat selector and lower brace. *Alphil Spot Welder Mfg. Co.*

Circle No. 31

BUY the BEST

It's the entirely new
FIBRE-METAL
"QUALITY LINER"
LINE

for WINTER WARMTH & COMFORT

Warmth, durability, comfort and convenience are built into Fibre-Metal's completely new *quality* line of winter liners... for greater worker safety and "work ability." Designed for all safety hats and caps in the field, these winter liners are made of high quality, water-repellent, mercerized and sanforized fabrics... expertly tailored for maximum service life. *Ask your welding and safety supply distributor* NOW for our more descriptive bulletin or just order by model number and size.

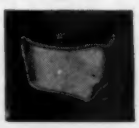
Model FLF (Small and large sizes). For cold to frigid climates. Heavy gray outer flannel, red knit lining. Long neck for extra wind protection. Chin strap with adjustable snap. Provision for snap-on MF Mouthpiece to give additional face protection!

Model FLF-I (Large size only). Same as FLF but includes an extra urethane inner lining for maximum warmth in ultra-frigid climates. Provision for MF Mouthpiece.

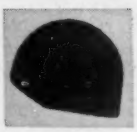
Model FLF-Z (Small and large sizes). Same as FLF but features zipper detachment of ear flap and neck section. For mild to frigid climates. Chin strap with adjustable snap. Provision for MF Mouthpiece.

Model FLF-E (Small, Large and Extra-Large sizes). For use with all types of electrical safety hats and caps. Same as FLF but NO METAL PARTS! Long neck for extra wind protection.

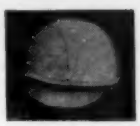
Model FLN-E (Small and Large sizes). Has yellow Neoprene-coated outer fabric for exceptional warmth retention and resistance to all wind and weather (sleet, snow, rain!) conditions. Extra long neck. NO METAL PARTS makes it ideal for use with electrical safety hats and caps.



Model MF Mouthpiece for Models FLF, FLF-I and FLF-Z for use where face protection against cold and wind are necessary. Snap on! Same high quality fabrics.



Model FLK (Universal size). 100% Navy Blue wool. Fits all heads. May be used separately or with other winter liners for greatest warmth and comfort.



Model HLP (Universal size). Features rayon screen laminated within two layers of wet strength paper. Cotton edge binding. Form fitting, highly absorbent, costs very little. For perspiration absorption and for use as a sanitary "visitor's" liner.

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Heavy duty, standard throat depth, (forged steel).	Commercial duty, standard throat depth, malleable alloy.	Heavy duty, forged steel.	Regular duty, extra deep throat, forged steel.	Regular duty, standard throat depth, ductile alloy.	Quick acting, modern design, ductile alloy.	Heavy duty, standard throat depth, ductile alloy.

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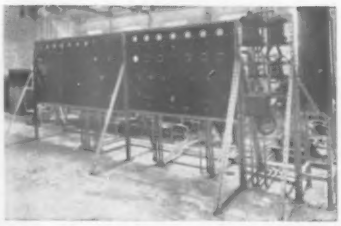


Steel angles

Slotted steel angles in new sizes have unlimited applications in light, medium, and heavy duty construction. Angles are simply cut to size and bolted together to form practically any desired construction. Available in following sizes: 1¼ x 1¼ x 10-ft x 16-gage; 1⅝ x 1⅝ x 10-ft or 12-ft x 14-gage; 2¼ x 1⅝ x 10-ft or 12-ft x 14-gage; and 3⅛ x 1⅝ x 12½-ft x 12-gage. *Kulhman Electric Co.*

Circle No. 32

Timing controls

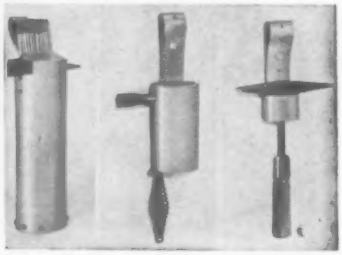
Electronic timing controls for resistance welding equipment feature plug-in panels for easier servicing. Weld timer (model 1A) controls weld time, is used primarily for foot-operated welder. Squeeze-weld timer (model 2A) permits controlled squeeze time before weld time is initiated, and can be applied to air-operated welders. Model 3B and 5B are sequence timers, permitting finer control, and applicable to automatic operations. *Alphil Spot Welder Mfg. Co.*

Circle No. 33

Beveler

Model X-8 beveler makes preparation of steel plate for fillet welding fast, easy and accurate, states manufacturer. Serrated cutting wheel feeds the work through the machine as a predetermined bevel is neatly cut from the edge of the plate. Available in models that cut 30, 37½, or 45-deg bevels. *American Pullmax Co.*

Circle No. 34



Safety holsters

Weldors can carry hammers at their belts with new line of "fast draw" safety holsters. Made of heavy full grain saddle leather, holsters are offered in three models. Model 19 has adustable belt which allows wearer to carry tool at any convenient height. Model 21 is designed particularly for carrying combination weld chip-brush tools. Model 192, "dual case" is a full length case with belt loop at bottom and holds supply of welding rod as well as chipping tool. *Atlas Welding Accessories, Inc.*

Circle No. 35

Never before! the FIRST truly REVERSIBLE Welder's Glove

NO exposed seams on EITHER SIDE!

PERFECT FIT on EITHER HAND!

FRONT and BACK LOOK ALIKE

PACKED SINGLY Buy 3 instead of a pair. Can outlast 2 or 3 pairs.

It took 8 long years to design and perfect this truly interchangeable glove. Finest quality HORSEHIDE full fleece lined. Ask your dealer or write us.

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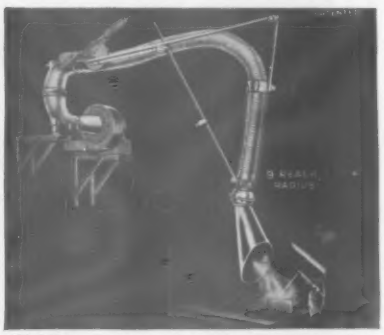
Circle No. 208 on Readers Service Card

Remove Welding Fumes at the Source... with RUEMELIN FUME COLLECTOR



Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed.

Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle.

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Circle No. 209 on Readers Service Card

Ultrasonic tester

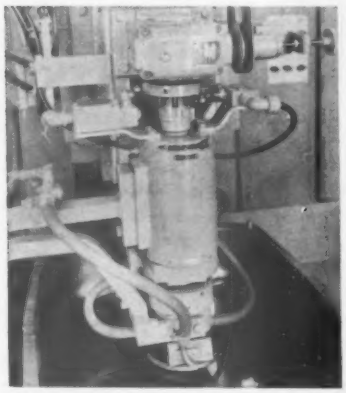
Ultrasonic materials tester can be used for flaw detection, either surface or internal, thickness measurement from one side, and determination of physical and structural properties. Unit is completely portable, can use any common plant power supply. Components include a generator and receiver for high frequency vibrations sent in a pulsed beam through subject material. *Circo Ultrasonic Corp.*

Circle No. 36

Lightweight face shield

Designated "Feather-Lite F-90," new face shield weighs only 3¼ oz complete with a 6-in. x 1⅝-in. x 0.020-in. window. Headband (adjustable in 1/8ths from 6 5/8 to 8) is made of softly pliable polyethylene, will not mildew, rot or sour and may be cleaned with any detergent or soap, according to manufacturer. Window-deflector section pivots easily and remains secure in any working position on friction joints. *Fibre-Metal Products Co.*

Circle No. 37



Wobble head welder

Typical uses for wobble head welder include welding filler necks and large drains to tanks, welding heat-exchange tubes to header plates, and welding flanges to large-diameter thin walled tubing. Electrode is a circular cup-type die running on an adjustable eccentric drive. Cup die works on edge, touching the workpiece with rolling, not sliding, point contact. Unit is ideally suited for handling ring welding jobs from 3/4- to 6-in. in diameter, states manufacturer. *Precision Welder and Flexopress Corp.*

Circle No. 38

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They mean National Carbide's calcium carbide— Real potent... it's hot-crushed!
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FIELD TESTS PROVE
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MORE THAN 50%
WITH MIR-O-COL M-700

The Semi-Automatic Open Arc wire feed unit is designed for the application of specially fabricated alloy wire by the open arc process. It operates on AC and DC or CV welders at 175-600 amperage range. Deposits 12-20 pounds of 7/64" wire in one hour at average 265 amp. Small, compact, weighs but 55 pounds.

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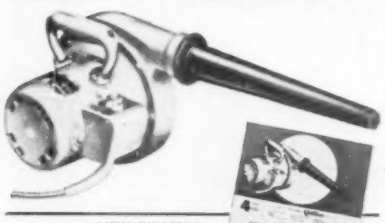

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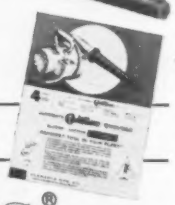

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...including powerful Model HP with 2-speed motor for double duty. Easy starting at low speeds prevents blowing of fuses. All models available with attachments for handling many special tasks.

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Blows dust, grit, chips and filings from hard-to-reach places. Use it as a suction cleaner for all kinds of jobs, or even to salvage bits of rare metal. Other models for annealing, soldering, and for preheating for bending.

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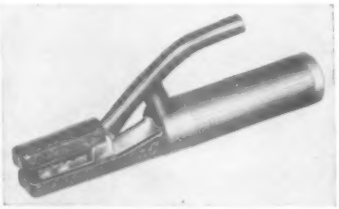
Flame hardener

Roller flange flame hardener has dual torches, enabling machine to flame harden both inside and outside of a rebuilt roller simultaneously, thus preventing distortion. Machine hardens renewed area to approximately Rockwell C 50. *Victor Equipment Co.*

Circle No. 39



Electrode holder

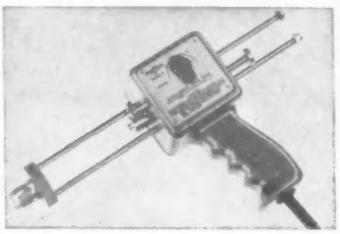
"Tong type" electrode holder has feature of allowing operator easily to adjust spring tension to his own preference. Aluminum model is rated at 300 amp and weighs only 12 oz. Low lever is designed for easy opening of jaws. Bronze model also available. *Duro Engineering Co.*

Circle No. 40

Test kit

Manufacturer of epoxy adhesives offers free test kit containing equal quantities of epoxy resin and hardener. Firm states its epoxy will not expand or contract, and is resistant to acids, alkalies, grease and solvents. *Fyberglas Industries.*

Circle No. 41



Spot gun

Model H spot arc weld gun features exclusive automatic time control to insure uniform and consistent welds from one side without backup. No triggers or buttons are used during welding operation. Weighing 2 lb, gun welds 14-gage to any thickness (minimum 2 pieces 26 gage). *Bren Weld Corp.*

Circle No. 42

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Circle No. 215 on Reader Service Card

Book Reviews

Conductor standards

ASTM STANDARDS ON METALLIC ELECTRICAL CONDUCTORS. Published by American Society for Testing Materials, Philadelphia. 1959. 358 pages; price $4.50.

This book's purpose is to present in convenient form for reference the various ASTM standard and tentative specifications and methods of test pertaining to electrical conductors. Sponsored by the organization's committee B-1 on wires and electrical conductors, the publication covers conductors made of copper, copper alloy, aluminum, galvanized or aluminized steel core, and non-ferrous metals.

Each chapter is broken into various considerations, e g., "sampling," "procedure," "reagents," "inspection," and "packing." Tables on approximate diameters and weights of completed conductors, density and temperature coefficients, construction requirements, and suggested package lengths are included. Diagrams help to clarify highly detailed points.

Brittle fracture

EVALUATION OF WELD-JOINT FLAWS AS INITIATING POINTS OF BRITTLE FRACTURE. Published by Office of Technical Services, U. S. Department of Commerce, Washington, D. C., 1958. Price $1.50.

A reprint of an original document resulting from government-sponsored research, this report deals with the conditions needed for initiation of brittle fracture from flaws 4 in. or less in length.

Findings of the study include the following:

—Residual and reaction stresses join with applied stresses to make up the total stress that is involved in the commencement of many brittle fractures.

—Flaws, especially cracks, of almost any size are potential initiation points of brittle fracture.

—A total stress of yield-point value or higher, in conjunction with some stress-raising condition, is necessary to initiate brittle fracture under service conditions from flaws of various sizes and types.

Line drawings, photographs, charts and diagrams illustrate the report.

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MORT CLARK'S GALV-WELD ALLOY ORIGINAL & GENUINE

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The Navy didn't believe, tested it 2384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959 —23 YEARS LATER!

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Free literature . . . use card on page 99

75. MECHANICAL DEBURRING—Wheelabrator Corp. Four-page, fully-illustrated folder details four methods of mechanical deburring, gives numerous examples of their application.

76. DOUBLE-END CUTTING—Steffan Mfg. Corp. Flyer is designed to show versatility of firm's contour cutter; describes, with text and pictures, double-end cutting operations.

77. TIP CLEANERS—Thermacote Co. Flysheets contain brief descriptions, prices for firm's tip cleaners and accessories.

78. WELDING PRODUCTS—Weldaloy Products Co. Catalog No. 59, 44 pages, lists specifications for company's line of electrodes, welding wheels, water cooled holders, dies, alloys, and castings and forgings.

79. GEAR HARDENING—Philadelphia Gear Corp. Full tooth contour induction hardening of large gears is subject of booklet No. 100.

80. METAL WORKERS—Homestrand Machine Tool Corp. Brochure covers Swedish-made sheet steel and plate working machinery, includes important specifications.

81. GAS CONVERSION STATIONS—Air Reduction Sales Co. Firm's complete range of liquid storage and conversion stations for installation are covered in 6-page brochure.

82. HYDRAULIC COMPONENTS—Denison Engineering Div., American Brake Shoe Co. Six-page bulletin discusses firm's components designed for hydraulic systems up to 5,000 psi.

83. HAND WELDING TORCH—Linde Co. Form 1155 lists advantages of hand welding Tig torch set forth in four-page folder which includes scale drawing of water-cooled HW-18.

84. STANDARD CLAMPS—Wittek Mfg. Co. Illustrations and condensed information are contained on wide variety of clamps for industrial use, including welding hose, in 16-page booklet No. 5-60.

85. STAINLESS STEEL WELDING—The McKay Co. Forty-eight-page booklet goes into considerable detail about the uses of stainless steel, includes analysis tables.

86. STEEL ELECTRODES—Hobart Bros. Co. Pocket-size card contains application information on all mild steel arc welding electrodes and explains how to identify them according to AWS-ASTM classification.

87. PLUG-IN DUCT—Westinghouse Electric Corp. Application data for plug-in bus duct are contained in 28-page booklet which includes descriptions, drawings, and specifications.

88. SUBMERGED-ARC PROCESS—Linde Co. Two booklets describe firm's submerged-arc welding equipment and operation: F-1379 lists entire line of machines, torches, and supplies; F-1376 goes into operation and cost-savings of process.

89. INDUCTION HARDENING—Caterpillar Tractor Co. Reports on applications of cutting-edge hardening are contained in illustrated booklet (form 33708).

90. LIQUID GAS—Air Reduction Sales Co. Four-page booklet covers the principles and techniques of handling, storing, and converting liquified oxygen, nitrogen, and argon.

91. HOSE CLAMP—Punch-Lok Co. Folder F-310 describes firm's hose clamps and portable locking tools.

92. SMALL PIPE WELDING—Lincoln Electric Co. Basic information concerning arc welding techniques for small diameter piping is contained in bulletin 2112.3.

93. TOOL COMPONENTS—PIC Design Corp. Catalog No. 16 lists complete selection of tool and fixture components.

94. THERMIT WELDING—Thermex Metallurgical, Inc. Information on thermit welding of reinforcing steel for heavy concrete construction is given in data sheet No. 5.

96. FLAW DETECTOR—Branson Instruments, Inc. Ultrasonic flaw detection is subject of bulletin T200, which includes operation, techniques, and complete list of specifications.

97. MIG WELDERS—Linde Co. Three styles of standard-component Mig welding machines are covered in catalog F-1393.

98. METALLIZING SPRAY—Metallizing Co. of America, Inc. Fully illustrated brochure explains many uses of metallizing process.

99. NITROGEN GENERATOR—Engelhard Industries, Inc. Booklet provides detailed descriptions of equipment which catalytically reacts air and ammonia over a platinum catalyst to produce oxygen-free nitrogen gas.

100. BRAZING FUNCTIONS—Handy & Harman Newsletter No. 38 describes, with illustrations, various applications of brazing, such as for tank housings, fork assemblies, yokes, and pistons.

101. SPRAY WELDER—Wall Colmonoy Corp. Illustrated 4-color bulletin (Form 300D) gives thorough description of firm's spray welder unit, also contains step-by-step outline discussion of spray weld process.

102. ARC WELDING ELECTRODES—Alloy Rods Co. Flysheet depicts and describes available electrodes by type and function.

103. SANDBLASTER—Hamill Mfg. Co. Form No. HB5360, a flyer, describes and illustrates compact, portable sand blasting unit.

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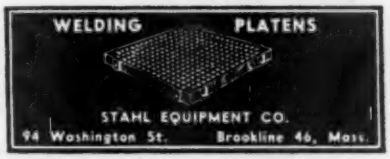

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W. C. Hollett

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DIVISION OF UNION CARBIDE CORPORATION
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104. HARDFACING — A. O. Smith Corp. New brochure MW-225 fully describes hardfacing and covers proper selection and application of hardfacing electrodes and wires. Includes comprehensive tables listing more than 25 of firm's styles.

105. TRANSFORMER—Taylor-Winfield Corp. Mechanical strength, insulation, heating, and tests of firm's transformers are discussed in 8-page brochure No. 9-013, which includes photographs of primary and secondary coil and winding, transformer dipping, and several types of completed transformers.

106. RUST PREVENTIVE—Wheelabrator Corp. Bulletin 1001 contains information on four types of rust preventive compounds, illustrates results of controlled laboratory tests of corrosion protection offered by compounds.

107. BARREL CARTS — Valley Craft Products, Inc. Flyer No. RSD 10M-4-60 describes and lists prices for line of drum and barrel trucks.

108. WELD DESIGN — Lincoln Electric Co. Bulletin 1204.1, a study in applied weld design, contains numerous line drawings and graphs to illustrate subject matter.

109. BRAZING TECHNIQUE — All-State Welding Alloys Co., Inc. Twenty-four page, illustrated manual (Form 5260) describes brazing techniques on all commercial brazeable metals and alloys.

110. MULTI-ARC WELDING — J. B. Nottingham & Co., Inc. Construction features, ampere ratings, dimensions, weight, etc. of single operator multi-arc welding units are listed in data sheet.

111. AUTOMATIC WELDING—Hobart Bros. Co. Six-page, 2-color folder illustrates and describes complete line of automatic and semiautomatic arc welding equipment of manufacturer.

112. WELDING PLATENS—Acorn Iron and Supply Co. Typical welding operations on platens are pictured and described in flyer.

113. ROD COATINGS — Croda Inc. Information sheet No. 2616 provides information on Protaweld TX120 Alginate, a plasticizer and binding agent for welding rod coatings.

114. REBUILDER — Victor Equipment Co. Flyer VH-2 gives brief discussion of features of double-arc, double-spindle roller and idler rebuilder.

115. HOSE CLAMPS — Ideal Corp. Newly revised catalog sheet 1-103 offers extensive information on firm's clamps for hose, plastic pipe, and varied industrial applications.

116. HIGH CURRENT THYRATON — National Electronics, Inc. Data sheet provides considerable technical information on firm's high current thyraton, includes graphs and line drawings.

117. EXTRUDED RECTANGLES — Ampco Metals, Inc. Extruded special aluminum bronze rectangles for severe wear and abrasion applications are described in revised bulletins.

118. RUST REMOVER—Rusticide Products Co. Flyleaf tells how firm's product removes rust and conditions metal surfaces of machinery, automotive and farm equipment, piping, sheet metal, bar stock, etc.

119. SILICON RECTIFIER—Westinghouse Electric Corp. Twenty-page publication presents a detailed description of a silicon power package and states advantages of silicon over other rectifying methods.

120. AIR CYLINDERS — Flick-Reedy Corp., Miller Fluid Power Div. Booklet 300 R—printed in 12 pages and hole punched to fit standard three-ring binders—contains detailed prices on firm's air and hydraulic cylinders, boosters, and accessories.

121. STRIP WELDERS—Taylor-Winfield Corp. Bulletin 603 explains operation and illustrates, in scale, firm's line of flash-butt strip welders.

122. PIPE CLEANING—Wheelabrator Corp. Use of firm's airless abrasive blast cleaning for removing mill scale and other surface corrosion from pipe used in oil and gas pipe lines is subject of 8-page, 2-color bulletin 155-D.

123. ARC WELDERS—Trindl Products, Ltd. Folder contains information on manufacturer's line of industrial welders.

124. OXYGEN UNIT—Linde Co. Uses of portable emergency oxygen cylinder unit are outlined in folder.

125. FILLER RODS—National Cylinder Gas Div., Chemetron Corp. Twenty-three welding filler rods for use in welding nine different metals are listed along with competitive brands in a comparison chart.

126. FIBRE-GLASS HELMETS—Sellstrom Mfg. Co. Bulletin 35-H briefly describes fibre-glass welding helmets with new plate retainer, nylon stationary plate retainer, and ratchet headgear.

127. TIP CLEANERS—Thermacote Co. Catalog sheets describe and list prices for tip cleaners.

128. FLUOROSCOPY—Philips Electronic Instruments. New 4-page folder, a reprint from a national engineering magazine, discusses new method for inspection of components and assemblies under actual operating conditions.

129. TIG EQUIPMENT—Air Reduction Sales Co. Liberally illustrated, 24-page catalog 2300 contains information on company's complete line of manual, semi-automatic and automatic Tig welding equipment; also, information on accessory equipment.

130. POWER SYSTEM—Robotron Corp. How to improve product quality and lower production costs on resistance welding jobs with "spike power" electronic control system is subject of folder.

131. ELECTRONIC CABLES—Zippertubing Co. Folder shows how zippered electronic cable is made, includes chart on characteristics of various types.

132. FILLER METAL—Aluminum Co. of America. Parent metal combinations of wrought alloys currently recommended for welding are indicated in table designed for shop men and engineers.

133. TRANSITION COUPLINGS—Project Fabrication Corp. Four-page folder sets forth operating uses of transition couplings for cryogenic service.

WELDING

INFO-AIDS

USE THIS CARD for literature, catalogs, and bulletins shown on preceding pages and on the following page, and for more information on advertisments in this issue.

Also information about

NEW PRODUCTS described on pages 84 to 94

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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★ For additional information on New Products described in this issue, circle the numbers of the items that interest you. The New Products section begins on page 84.

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Advertisers' Literature

Literature offered in advertisements which were received up to the 5th of last month. To get the literature you want, circle numbers on Reader Service Card on this page.

204. All-State Welding Alloys Co., Inc. — Manual on "Spoolarc" spooled aluminum wire.

195. American Optical Co.—Folder S-9033 further explains the "Kool-Vent" face shield.

167. American Platinum & Silver Div.— "A Complete Guide to Selective Fluxing For Low Temperature Silver Brazing" is available.

179. Bridgeport Brass Co.—Send for booklet, "Bronze Welding" by circling No. 179.

155. The Budd Co.—Gamma Radiography Bulletin, available.

202. Cam-Lok Div. — Bulletin No. 301 available on Receptacles and Plugs.

173. Eutectic Welding Alloys Corp. — Eutectic offers literature on "EutecTrode 680" and new Maintenance Welding Data Book.

219. Galv-Weld Products—Information and sample of galvanizing manufactured by Galv-Weld.

203. Goldsmith Brothers—GB Silver Brazing Data Book available, further explaining silver brazing alloys and their #88 flux.

154. Harnischfeger Corp. — Bulletin R-49 available giving the chemical range and mechanical properties of P&H stainless steel electrodes.

151. Hobart Brothers Co.—Bulletin U-90 available on Hobart's complete line of arc welding equipment.

152. Hobart Brothers Co.—For samples of Hobart's No. 10 welding electrode circle No. 152.

166. International Nickel Co., Inc.—Booklet available, "Repair Cast Iron Parts Quickly and Easily."

175. Merrill Brothers—Catalog C-2 available describing the Merrill "Twin Lifter" and other material handling devices.

183. Miller Electric Mfg. Co., Inc. — A booklet illustrating and describing Miller welders, "A Full Line of Fine Welders" is available.

193. Page Steel & Wire Div.—Booklets DH-402 and DH-1218 further explains "Page" automatic welding wire.

181. Rankin Mfg. Co.—Bulletin No.R101 on the new "Ranomatic" wire for automatic and semi-automatic hardsurface welding, is available.

174. Ransome Co. — Booklet available, "Guide to Positioning Equipment" further explains Ransome's positioning equipment for welding.

190. Riegel Textile Corp.—Catalog available on Riegel gloves for weldors.

208. Singer Glove Mfg. Co.—Catalog available on welding gloves and safety clothing manufactured by Singer.

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WARNING!

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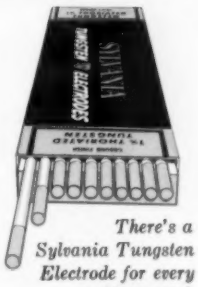
Whether you're welding the ventilating ductwork for a giant skyscraper, a transcontinental Big Inch, or hardware for outer space, TIG welding speeds the job and makes it easier. And for this kind of work, no finer Tungsten Electrode is made than by Sylvania.

Sylvania offers the most complete line of top-quality Tungsten Electrodes: Puretung®, Zirtung®, 1% Thoriated, 2% Thoriated. Each comes in the preferred finish—cleaned or ground, and color-coded to save time and prevent costly errors. Chemical & Metallurgical Division, Sylvania Electric Products Inc., Towanda, Pennsylvania.



There's a Sylvania Tungsten Electrode for every welding need.

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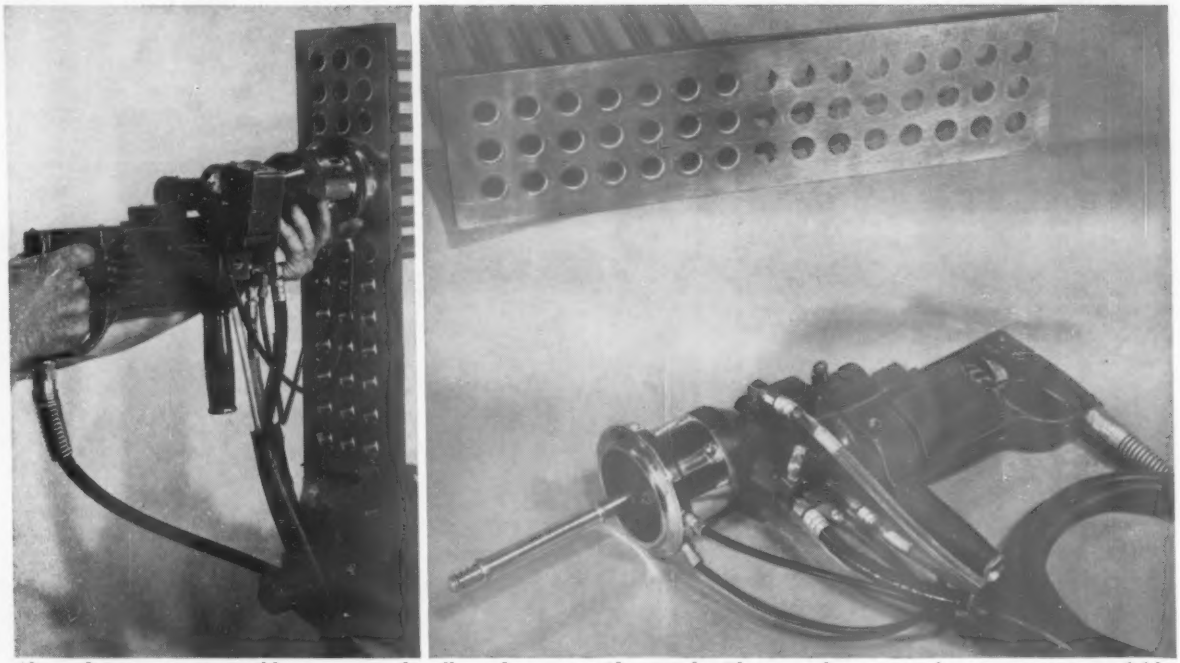

Above, left: Automatic welder is easy to handle and operate. *Above right:* Close-up of one type of automatic unit available for welding tubes to tube sheets. Note uniformity of sample welds above.

Mechanized welding process makes the permanently tight heat exchanger tube joints needed in modern power plants

The design and operation of modern steam power plants require that tubes in condensers and feed-water heaters be installed permanently tight to prevent contamination of the boiler water.

Welding the tubes to the tube sheets will insure this. In most cases, however, welding cannot be done manually for a variety of reasons. A mechanized process must be employed to produce consistently high quality joints.

Inert-gas tungsten-arc (TIG) welding has the advantages of simplicity, good control, and protective shielding without the use of flux. Tough, dependable equipment for automatic welding with this process—such as that shown in the illustrations above—is widely available. These units make it possible to weld, without the complication of filler-metal addition, most of the tube and tube sheet combinations employed in condensers and heat exchangers.

Joints, whether a few hundred or several thousand in number, are uniform in geometry and quality. Typical are the results obtained with tubes of Arsenical Admiralty-439 on tube sheets of Naval Brass-450, as shown in the 20X micrograph reproduced at the left, below.

Technical Assistance: The Metallurgical Department of The American Brass Company will gladly help you in the selection of suitable alloys and in welding procedures and the design of joints. This service is available without obligation. See your American Brass representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 6002

Micrograph 20X of typical weld section. Tube is of Arsenical Admiralty-439 and tube sheet is of Naval Brass-450.

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TUBES and PLATES for

CONDENSERS and HEAT EXCHANGERS

Made by The American Brass Company

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